FEBRUARY 1927—THIRTY-THIRD YEAR

MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 33 · FEBRUARY, 1927 Number 6

PRINCIPAL ARTICLES IN THIS NUMBER

DEPARTMENTS

Total Distribution for January, 16,729 Copies

PUBLISHED MONTHLY BY

THE INDUSTRIAL PRESS, 140-148 LAFAYETTE STREET, NEW YORK

ALEXANDER LUCHARS, President ROBERT B. LUCHARS, Vice-President EDGAR A. BECKER, Treasurer
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LONDON: 52 Chancery Lane PARIS: 15 Rue Bleue

YEARLY SUBSCRIPTION: United States and Canada, $3 (two years, $5); foreign countries, $6. Single copies, 40 cents.

"Sittin' Pretty"

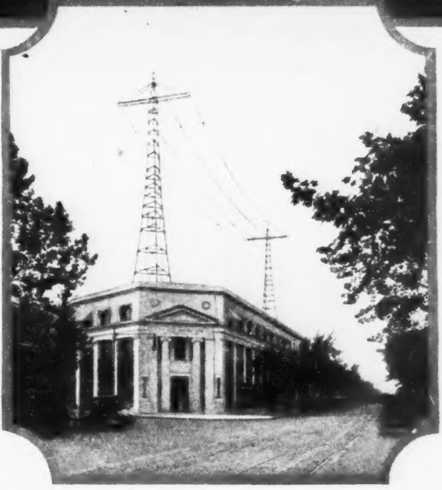
Is an expressive phrase, origin unknown, that exactly fits the *present* condition of a machinery manufacturing company which found, early in 1926, that with a fairly good run of business and exercising every possible economy, it was losing money. After a conference, two of the executives visited several other plants of similar size and character, which *were* making money, and discovered that none of their machine tools was over twelve years old. Some were less than twelve *months* old.

The result of a careful comparison of every detail of their own plant and work, showed that many of their lathes, milling machines, grinding machines, planers, drilling machines and gear cutters, were fifteen, twenty, and some even thirty years old. These were immediately disposed of—not a trainload like that pictured on this page last July; but enough.

These were replaced with the latest machine tools available, fewer in number than the old-timers, but the up-to-daters turned out about forty per cent more work in less time and with fewer operators.

G-r-a-d-u-a-l-l-y their loss turned into a profit, so that at the beginning of 1927 they were 'SITTIN' PRETTY.'

How Your Radio Set is Built



An Outline of the Many Processes Involved in the Manufacture of Radiolas

By CHARLES O. HERB

SIX years ago the building of radio receiving sets was done only in the experimental laboratories of large electrical companies or by amateurs who purchased the various parts and assembled them as more or less of a pastime. Radio transmission and reception of voices and musical instruments were just beyond the first stages of development, and there was only one station broadcasting a program of entertainment in the United States (Station KDKA, East Pittsburg, Pa.) The total number of "listeners in" at that time, was estimated to be not greater than 1000.

Conditions are vastly different today. About 650 stations broadcast programs to every section of this country and, with the exception of a few "dead" spots, these programs can be received with the simplest kind of a set. Radio even penetrates into mines and bank vaults. Opera stars, concert orchestras, lecturers, and statesmen appear nightly before the microphone to provide programs of recreation and education to an audience of, perhaps, 20,000,000 persons. There are estimated to be 6,000,000 radio receivers in use, the majority of which have been built commercially. The industry developed to meet the demand for radio receivers and units has had a remarkable growth. It has been estimated that in 1925, radio, directly and indirectly, gave employment to over 250,000 persons, and radio sales totalled $350,000,000.

A Radio Set is not Built in a Day

It is a far cry from the experiments of the radio technician to the manufactured set. Months, even years, are spent in developing radio circuits that are commercially practical. In the eight-tube Super-heterodyne set built for the Radio Corporation of America by its associates, the Westinghouse Electric & Mfg. Co. and the General Electric Co., there are over 4000 parts. Obviously, it is one thing to develop such a set in the laboratory and quite another to construct thousands of similar parts. In the case of the set referred to, economical production methods had to be developed for manufacturing each of the 4000 parts, assembling them into units, and finally building the units into sets.

Engineers are constantly employed in developing and tearing down circuits in the never-ending search for still better means of radio reception. Radio principles have been quite definitely established, and most of the present research has to do

Using a Snap Gage for Inspecting Vacuum Tube Bulbs

Inspecting Vacuum Tube Plates with an Indicator Gage

Bending Tiny Wires in One of the World's Smallest Presses

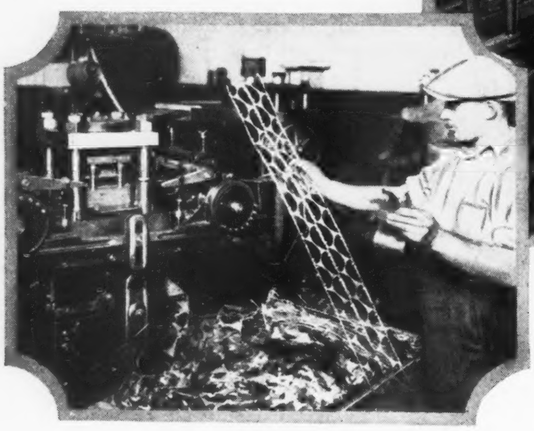
with modifications and improvements of existing circuits.

When a circuit has finally been decided upon, various models are made, and these are subjected to "third-degree" tests. The most promising of these models are turned over to the engineering departments for the development of a commercial product. In due time, bench models appear in the laboratory, which are to all intents and purposes, forerunners of commercial receivers. These models must prove acceptable to the radio, production, and sales engineers before plans can finally be developed for placing the set in production.

Miles and Miles of Wire are Used for a Single Receiver

Mile after mile of wire, in some cases finer than human hair, is wound into compact coils which are assembled into transformers and coupling units. In one loud speaker alone, there are over five miles of wire wound into 18,000 turns. The wire is rolled and drawn from copper ingots, and then insulated with cotton, silk, rubber, or enamel. Enamel is largely employed in the case of the finest wire, because it gives a tough glass-like coating and occupies minimum space.

Machine Tools are Used Extensively in the Production of Parts for Radio Receivers



A Few of the Many Machine Tool Operations are Shown in these Views

Bare wire is drawn from a spool into one end of an enameling machine, passed through an enameling bath, then through an electrically heated oven, the temperature of which is closely controlled, and finally through a second enameling bath and electric baking oven, and so on, building up coat after coat of enamel. Some copper strands are given as many as twelve coats of enamel and a baking process between each coating.

Rubber insulated wire is wrapped with silk or cotton of various colors, so that different conductors of a radio receiver can be readily identified. Similar wrappings are placed around groups of wires to form cables. After the insulating operation, the wire is taken to coil winding machines. One girl attends three of these machines, threading the wire at the beginning of an operation, placing a fiber core into the machine, and setting an indicator for the number of turns desired in the coil. Each coil is tested to insure satisfactory service.

Carefully planned detail manufacture has reduced the wiring of receivers to simple terms. The various connections are made up in large quantities to meet the requirements of assemblers, and even bus bars are bent in fixtures to the proper size and shape, with loops formed at the ends. As the parts are strictly interchangeable, there are few chances of errors in assembling them.

Machine Tools Play an Important Part in Radio Manufacture

Hundreds of thousands of screws, bolts, and nuts are used daily in the production of radio sets. These parts are manufactured from bar stock by automatic screw and nut machines. Automatic chucking machines are employed for finishing the iron shells that serve as electromagnets in the larger Radiola cone loud speakers. Transformer cores and condenser plates are blanked out in automatic power presses, a battery of these presses being operated by one man. The condenser plates are produced from brass strips at the rate of 240 per minute per machine, four plates being blanked at each stroke of the press. As may be seen from one of the illustrations, the scrap from this operation resembles lace of a delicate pattern. The transformer laminations are produced from strips of steel welded together so that they can be fed continuously through the presses.

Rows of small punch presses for stamping and bending many parts are operated by girls. Even such a simple piece as a connection lug must go through several press operations. A typical operation is shown in one of the illustrations, in which a girl may be seen bending tiny wires on a little glass bead later assembled into a vacuum tube. Large power presses are employed in producing metal cases used for holding radio accessories.

After the condenser plates are taken from the power press, they are rolled flat and inspected for thickness. The thickness must not vary more than 0.0001 inch. At the end of this operation, the

plates are die-cast into stator and rotor assemblies, and these units are assembled into the condenser proper. A large amount of careful hand work is required, and much filing and polishing with emery cloth, because there must be uniform spacing of the plates, with a minimum clearance.

The various parts of mica fixed condensers are punched out and formed in small presses, assembled into a metal case, and pressed into a permanent unit. Wire condensers are produced from rosin-covered wire, with a second wire wrapped around the insulation to form a unit of extremely small capacity. By unwrapping the outside wire, the capacity of the condenser may be varied

Countless Inspections and Tests are Performed before a Radio Set is Packed for Shipment

ever so slightly. Girl inspectors use delicate measuring instruments to determine how much wire has to be unwrapped in order to obtain the desired capacity.

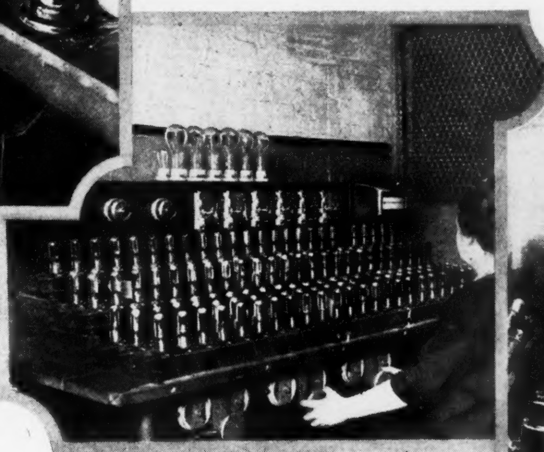
Grinding wheels, tumbling barrels, and buffing wheels are employed for removing the rough edges of metal parts and for polishing the parts. Many pieces are afterward coated with nickel, gold or silver. Small parts are dumped into a barrel for the operation, and are tumbled until the process is completed. Large parts that are to be nickel-plated, are suspended from trolleys that carry them through a series of plating and rinsing tanks. Parts are japanned by a spraying process conducted under hoods which are equipped with exhaust fans to remove the fumes.

Vacuum Tubes Rival Aladdin's Lamp

Aladdin's lamp is rivalled by the vacuum tube. This present-day miracle lamp takes the voice of man at a studio microphone and increases its power over 50,000,000,000 times. It has been estimated that if every person on earth were to shout in unison, the total voice power would be only one-thirtieth of the power of a broadcasting station. The vacuum tube converts plain direct current into high-frequency current for propagating radio waves; magnifies or amplifies delicate electrical variations to unbelievable proportions without distortion of the original values; rectifies alternating current into direct current; and enables a powerful current to be controlled by a very weak current.

The manufacture of "Radiotrons," as the vacuum tubes marketed by the Radio Corporation of America are called, is an intricate process involving the most delicate forms of glass work, as well as the making of metal parts within close tolerances. There are thirteen stages in the production of a "Radiotron," and at each stage, the tube is rigorously inspected and tested. Automatic machines and nimble-fingered girls produce thousands of these tubes daily. Production begins with the making of filaments, minute anchor wires, lead-in wires, glass tubing, plates, etc. These parts are assembled progressively into units that are finally assembled into glass bulbs. The air is exhausted from the bulbs, and they are then sealed, treated, tested, and packed for shipment.

Glass tubing used in the manufacture of vacuum tubes comes from the glass works in unit lengths, several feet long. It is carefully inspected for uniformity of diameter and thickness of wall, and for flaws and brittleness. The glass tubing is then taken to automatic machines, where it is cut into pieces of the proper length. Tiny flames from gas burners play on all sides of the tubing at the point where it is



Two of the Many Tests Performed on the Tubes

to be cut, and bring the glass to a red heat. Then a cutting wheel inside the tube and one on the outside feed toward each other and sever the tube neatly.

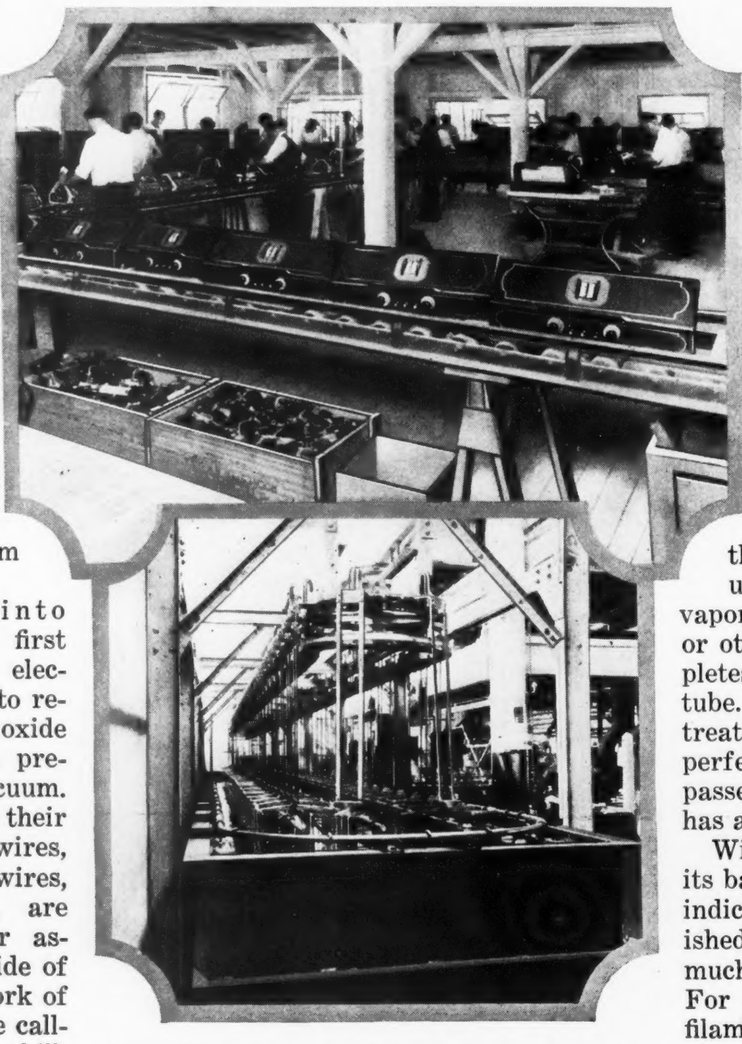
The stem-making operation is, in itself, a study in mechanical ingenuity. In this operation, the glass stem and its embedded lead wires are assembled to support other members of the vacuum tube, and to establish connection with the contact pins of the base. They also support the exhaust tube, which is ultimately used to draw the air from the tube and seal it. Formerly, vacuum tubes were exhausted at the tip, but improved manufacturing methods have made possible the tipless tube.

The standard stem-making machine has twenty-four heads for handling as many assemblies. The operator simply places the lead wires in holes in each head, together with a flare tube that surrounds the wires, and the machine does the rest.

As each assembly passes, step by step, around the machine, it is treated successively to varying degrees of heat by the gas flames. When the tube has been properly heated, it is pinched, pressed, and formed. Each machine produces an average of 400 completed stems per hour. The stems then pass through an annealing furnace, where they are treated to a gradually diminishing heat, so as to insure proper cooling without undue strain on the glass. The stems finally drop on a conveyor which carries them to the inspectors. This conveyor is divided into as many sections as there are stem-making machines, so that the inspectors can readily trace defective stems to the machine producing them.

The plates for vacuum tubes are stamped out of nickel sheets and formed in presses, to be riveted or clamped into their final shape. The grids are made of molybdenum steel wire, and supported by a piece of nickel steel wire. Machines take the nickel steel wire and produce nicks in it, after which the molybdenum steel wire is wound on the supporting wire to form the grid.

Parts assembled into vacuum tubes are first placed in hydrogen electrically heated ovens to remove all traces of oxide and moisture, which prevent a satisfactory vacuum. The glass stems, with their formed and cut lead wires, the filaments, anchor wires, plates, and grids, are brought together for assembling into the inside of the bulbs. This is work of a most delicate nature calling for considerable skill. It is handled by girls, using tweezers and accurate fixtures. Spot welders are also used extensively in assembling these various parts.



Upper View Shows how Roller Conveyors Expedite the Assembly of Radiolas. Lower View Shows Battery of Nickel-plating Tanks

Why do Radio Tubes have a "Silver Lining"?

To insure perfect vacuum in a finished tube, it is necessary to use some chemical that will absorb all the oxygen that may remain in the pores of the metal parts, even after a high vacuum exhaust. This chemical is known as the "getter," and in most "Radiotrons" it consists of a small piece of magnesium, which is fastened to the plate. After the tube has been exhausted and sealed, this magnesium is vaporized and becomes deposited on the inside of the bulb, forming a "silver lining." Other "getters" produce linings of different colors.

In the final assembly of vacuum tubes, the assembled stem is placed in an automatic machine, with the exhaust tube at the bottom pressed into a rubber tube. Oil is employed to insure an air-tight joint between the glass exhaust tube and the rubber tube. A glass bulb is next slipped over the stem assembly, and then as the tube travels around the machine, gas flames play on the long neck of the bulb at a point opposite the flared bottom of the inserted stem.

As the bulb is heated, the neck and the flared bottom of the stem are gradually brought to the melting point, and the two parts come together to form a seam, by the combined action of gravity and centrifugal force. A little puff of air is blown through the glass neck of the bulb directly below the freshly made seam, so that the portion below the seam breaks away, leaving a sealed tube.

During the operation, the air inside the tube is exhausted and the exhaust tube sealed. Finally, high-frequency coils are placed over the sealed tubes to bring the plate inside the tube up to a red heat. This vaporizes the magnesium or other "getter" and completes the evacuation of the tube. Just before the heat-treatment, the glass bulb is perfectly clear, but when it passes from this stage, it has a silvery appearance.

With the bulb sealed in its base, the tube has every indication of being a finished job; yet electrically, much remains to be done. For one thing, the special filament material requires seasoning before it is ready for use. This consists of burning the filament at different voltages for varying periods of time, with the application of plate current at certain stages. In this process, which is shown in one of the accompanying illustrations, 150 tubes are seasoned at one time.

After the aging, each tube must be tested for plate current, gas content, filament emission, amplification, and mutual conductance. There is also a "jigger" test, in which the vacuum tubes are given an electrical inspection for short circuit, misplaced elements, broken or burned out filaments, etc. The electrical specifications are most exacting, with the result that despite the utmost precision in manufacturing operations, and the frequent tests during production, a considerable proportion

of the total output is discarded in the final electrical tests.

All Defective Vacuum Tubes are Destroyed

Every tube that fails to measure up to proper manufacturing and operating specifications is ground into unrecognizable bits by a so-called "rock crusher." This is done to prevent unscrupulous tube manufacturers from obtaining large numbers of standard bases, stems, plates, and other elements and "doctoring" them up with imitations of the remaining elements of tubes.

The crushing machine consists of two main units, an assorting table, and a grinding wheel. There are a number of holes in the assorting table, each of which is labeled to receive one type of tube. Pipes underneath the table extend from each hole to one main pipe, which passes through the floor into a large bin. At the mouth of each pipe, directly under the hole in the assorting table, there is a shutter-counter, which keeps an accurate record of the number of tubes put into that pipe. Within the pit is the grinding wheel which breaks the small pieces of wire, glass, bakelite, etc., into fine pieces.

Radiolas are Assembled on Conveyors

The individual parts produced in the various departments are sent to assembly departments to be built into sub-assemblies, such as rheostats, variable and fixed condensers, jacks, terminal strips, and sockets. In one department, the "catacomb" or "heart" of the set is built. This unit consists of numerous coils, fixed condensers, high-resistance units, and an elaborate frame, all of which are soldered in place as the "catacomb" moves along a roller conveyor. At one point along the conveyor, twenty connections are soldered. In the soldering steps, delicate connections are wrapped with thread, treated with flux, and then immersed in molten solder. The unit is finally embedded in a sealing compound, and placed in a metal container. This container is later sealed to prevent the future owner of a Radiola from tampering with the highly important parts enclosed in the box.

All sub-assemblies are finally delivered to various points along a roller conveyor, and assembled progressively into a steel frame. At one end of this conveyor, there is another conveyor at right angles to the first, carrying cabinets into which the set is placed and securely fastened. As each cabinet continues along the conveyor, one man mounts the loop, another places directions within the cabinet, and a third puts the set to a final test on actual broadcasting signals. Minor details are then carried out until the set reaches the end of the conveyor, packed and ready for shipment.

Seven Prizes for Articles on Ingenious Mechanisms

MACHINERY offers seven prizes for the seven best articles on ingenious mechanisms, each article to be confined to one mechanism or mechanical movement.

One prize—$100
Two prizes—each, $50
Four prizes—each, $25

In addition to the prizes awarded, regular space rates will be paid for the prize-winning articles, as well as for any accepted articles that may not receive a prize.

Each contestant may send as many articles as he wishes. All will be entered in the competition, and all may be accepted for publication, but no contestant will receive more than one prize.

Articles entered in this competition should be addressed to the Editor of MACHINERY, 148 Lafayette St., New York City. They must be mailed on or before April 1.

Preparing Articles for the Competition

This competition applies to any kind of mechanism making use of a practical and ingenious mechanical motion or principle. The competition is open to all, whether subscribers to MACHINERY or not. The general procedure is very simple.

1. Send a drawing of the mechanism (or photograph, if preferred—or both) that clearly shows all important parts of the particular movement to be described.

2. Describe as clearly as possible both the *purpose* of the mechanism and its *action*—*how* it does *what* it does.

3. Mark the important parts on the drawing, such as levers, cams, etc., with letters, *A*, *B*, etc., and use corresponding letters to identify those parts in the description; thus: "Lever *A* is operated by cam *B*, etc." This will help to make the description readily understood.

4. Confine each article to a single mechanism or movement, and do not describe an entire machine or refer to parts that do not affect the movement being described.

Suggestions about Illustrations and Manuscripts

Clear blueprints or pencil drawings with distinct lines are satisfactory. Send only drawings that are "to scale," with the various parts shown in correct relationship and proportion. Rough free-hand sketches cannot be used. The drawing must show the assembled mechanism, although a diagram or drawing that is partly diagrammatic may often be substituted to advantage, especially if it more clearly illustrates the arrangement of a complicated mechanism.

It is more essential that important facts be clearly stated than that the manuscript be neatly written, but carefully prepared manuscripts usually indicate careful thought.

Avoid describing a mechanism that is familiar to most designers; descriptions of movements that are generally known cannot be accepted, even though they may be very ingenious. It is immaterial how long ago a mechanism or movement was originally designed, provided it has not been described in any publication or text-book.

Use of Angular Contact Ball Bearings

By T. C. DELAVAL-CROW, Chief Engineer, New Departure Mfg. Co., Bristol, Conn.

A REDUCTION of manufacturing costs due to simplification of design, and also, reduced upkeep due to the fewer number of parts used, can be obtained by using ball bearings that will carry combinations of thrust and radial loads, in place of anti-friction or plain bearings to sustain the radial load, and a ball thrust washer to support the thrust. How this simplification of design can be obtained with reduction in cost and increased efficiency is evident by comparing the two types of worm-gear mountings in Figs. 1 and 2.

These designs are worked out according to good engineering principles, but that shown in Fig. 1, is subjected to limitations due to the use of unifunctional bearings. It will be observed in Fig. 1 that three bearings are employed on the worm-shaft, namely, two annular bearings to carry the radial load and one double ball thrust to resist the thrust. Not only is an excessive number of bearings used, but with the ball thrust type of bearing, special spherical seated washers are needed, and the housing design becomes complicated and more costly to machine.

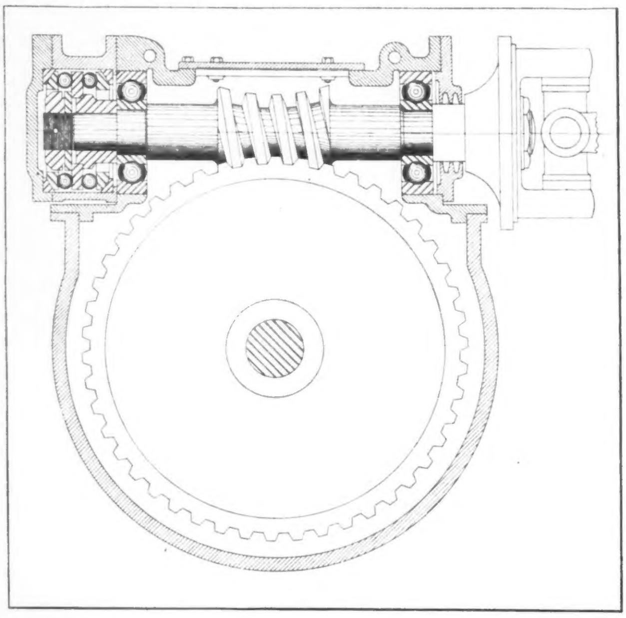


Fig. 1. Worm with Single-row Radial and Double-row Thrust Bearings

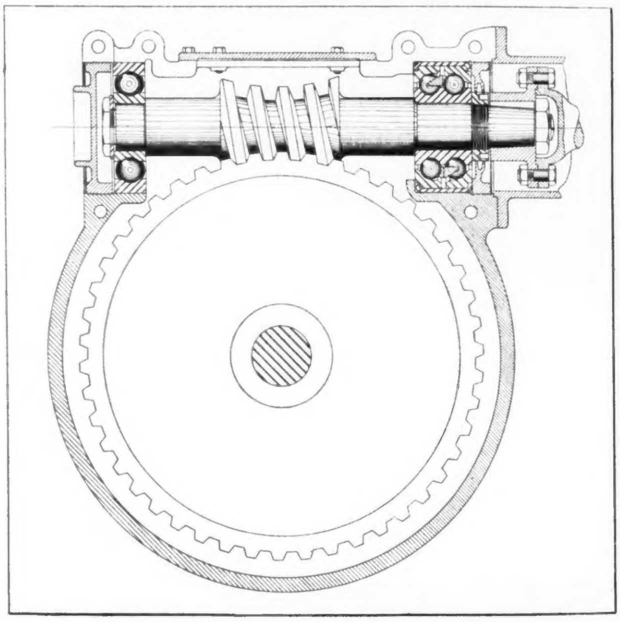


Fig. 2. Simplified Design, with Double- and Single-row Ball Bearings

In the simpler design, Fig. 2, only two bearings are used. What is called a double angular contact bearing is placed at the front end to sustain the radial load and resist thrust from either direction. The rear bearing then need only sustain a radial load, and is of the annular single-row type, so mounted that it floats endwise to allow for shaft expansion. It is obvious that this design reduces the bearing cost, simplifies the machining, increases the mechanical efficiency, and reduces the liability of bearing trouble. There are more interesting applications of angular contact bearings, but before explaining these, it is well to dwell upon the method in which an angular contact bearing functions.

The early type of ball bearings known as the cup and cone type, which were used in the bicycle, were of angular contact form. These bearings were not very successful when used to sustain heavy loads, but this was due to the materials and workmanship, rather than to the design. Again, in the earlier ball bearing applications, it was believed that the radial bearing would not sustain thrust or combined load. This, however, was not due to the material used, but rather to the design of the annular bearing at that time.

Combined Radial and Thrust Bearings

In nearly all types of mechanism, there may be two kinds of loads—a radial load acting at right angles to the shaft, and a thrust load, acting in a longitudinal direction relative to the shaft. These loads may be operating individually or in combination, but modern ball bearings of either angular or annular type can sustain combination loads within their capacity; in fact, a ball bearing of correct design has greater capacity under certain combined loads than when functioning under pure radial load. The reason for this is obvious, considering the fact that the load-carrying capacity of a ball bearing is dependent on the number of balls in contact with the races under load.

Again, in general, the stated carrying capacity of a bearing is its ability to withstand pure radial load, and under combined loads, its capacity must be modified so that the allowable maximum load on the heaviest loaded ball under pure radial conditions is not exceeded by any load made up of thrust and radial combinations. Under pure radial load, approximately only one-third of the balls are

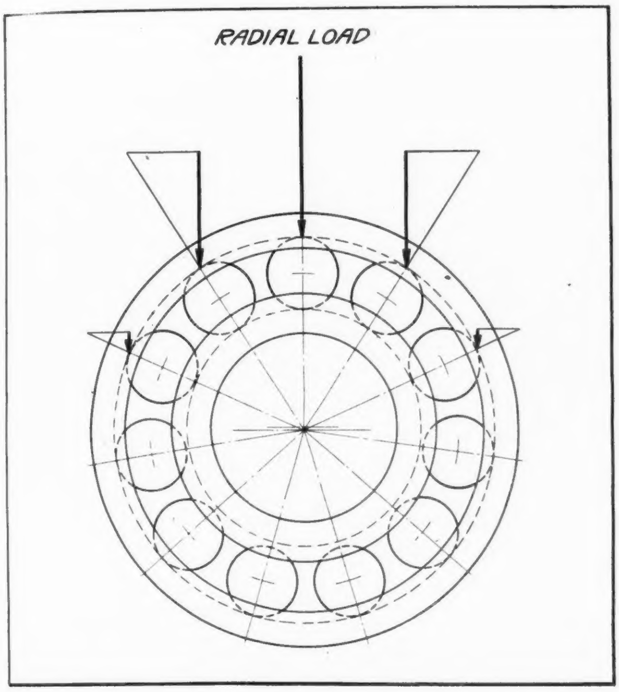


Fig. 3. Diagram Showing Distribution of Load on Single-row Radial Bearing

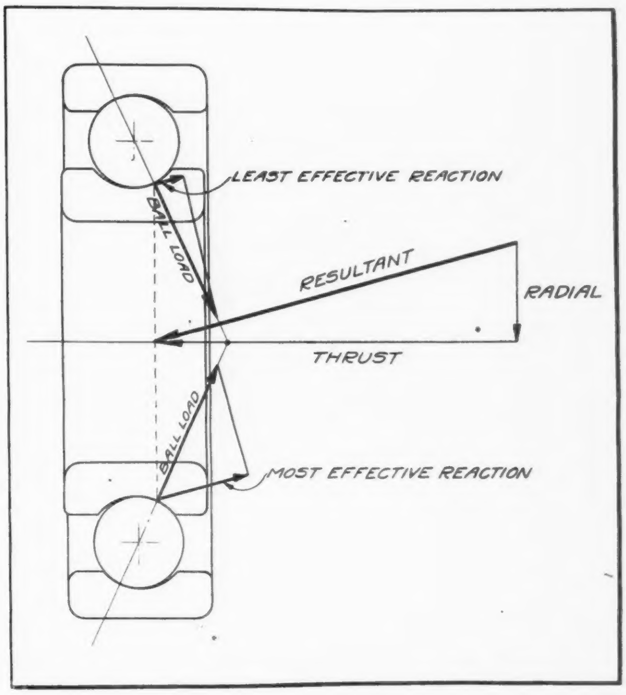


Fig. 4. Diagram Showing Distribution of Load on Combined Radial and Thrust Bearing

sustaining load at any time, as shown in Fig. 3. Under pure thrust load, all the balls are supporting load. Hence it is obvious that when the radial load is greater than the thrust load, a certain number of balls below the center line of the bearing opposite the applied load, will not be subjected to load, due to deformation of the parts. However, if the thrust load is greater than the radial load, all the balls will be loaded, and the maximum loaded ball will be the one subjected to maximum combined thrust and radial load, as shown in Fig. 4.

Angle of Contact Determines Thrust Capacity

The actual figuring of the capacity of a ball bearing under combined loads is complicated and will not be touched on in this article, although, as a matter of interest, it may be stated that the capacity is a function of the maximum safe ball load, the angles of contact and of load application, as measured from the plane of the balls, and also the center angle between the balls. As the pure thrust capacity of the bearing is increased by enlarging

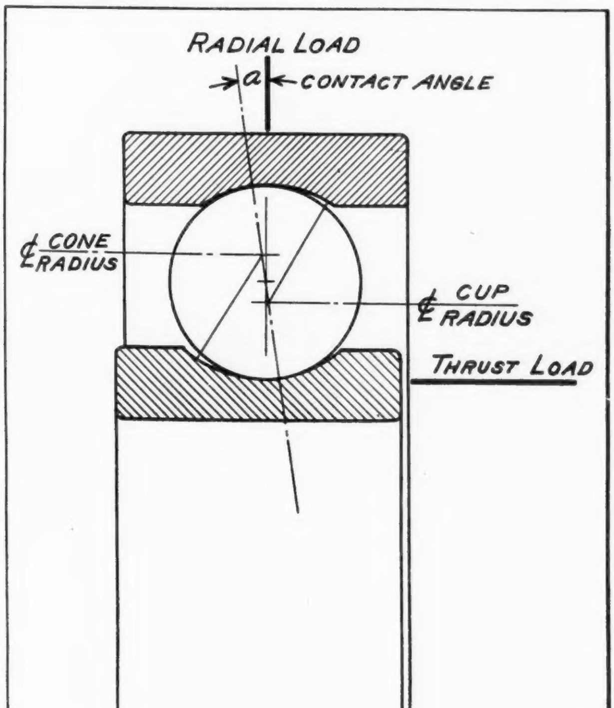


Fig. 5. Diagram of Bearing Subjected to Both Radial and Thrust Loads

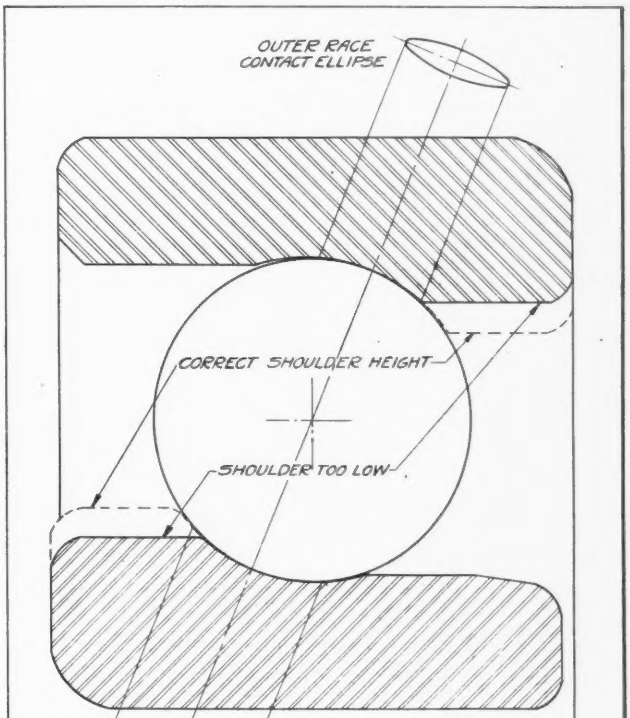


Fig. 6. Action of Bearing with Insufficient Height at Shoulder

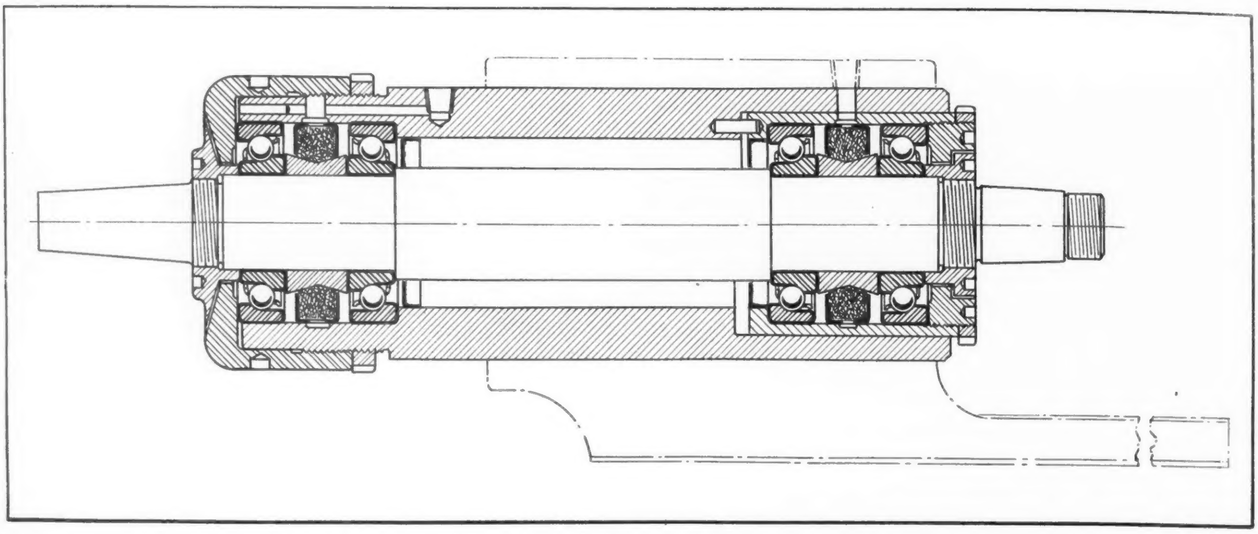


Fig. 7. Grinding Spindle Equipped with Four-bearing Mounting

the angle of contact, there is a reduction in pure radial capacity. For example, a bearing having an angle of contact of 10 degrees will carry as thrust, 77 per cent of its radial capacity, whereas its radial capacity is reduced 1.5 per cent. Again, a bearing having an angle of contact of 30 degrees will carry as pure thrust, 252 per cent of its radial capacity, and has a loss of 13.4 per cent in radial rating.

Any ball bearing under combined loads becomes an angular contact bearing. This angle of contact can either be incorporated in the design or obtained by deformation of the parts under load. In other words, what is known as an annular bearing becomes an angular contact bearing when thrust is applied. Under pure radial load, the contact between the balls and races is in line with the applied load and at right angles to the shaft, but as soon as thrust load is applied, the contact becomes angular and is caused by motion between the inner and outer races, Fig. 5, until the material is deformed sufficiently to resist the load.

Action of Thrust Bearing

The thrust-carrying ability of any radial or angular contact bearing is dependent upon the angle of contact incorporated in the design, and also upon the height of the race shoulders compared to the ball diameter. It is well understood that the contact between a ball and race whose curvature closely approaches that of the ball is an ellipse, not a point. This ellipse, however, is of considerably greater area than is often supposed, and the problem in design is simply that of making the height of the race shoulder such that the contact ellipse is completed and not cut off by a lack of height in the race shoulder, as shown in Fig. 6.

The objection has been raised that, owing to the difference in race contact radii, as indicated in Fig. 9, the ball must spin, and therefore, excessive friction is set up. Actual tests have shown that this is not the case, as two angles of contact are formed—one on the outer and one on the inner race—and lines drawn tangential to the balls at these points of contact will converge approximately at the center line of rotation, indicating that the spinning action is reduced to a minimum, which is proved by tests under pure thrust, in which a definite track is shown only on a portion of the ball circumference. If the ball spun, no such track could exist. However, it must be pointed out that

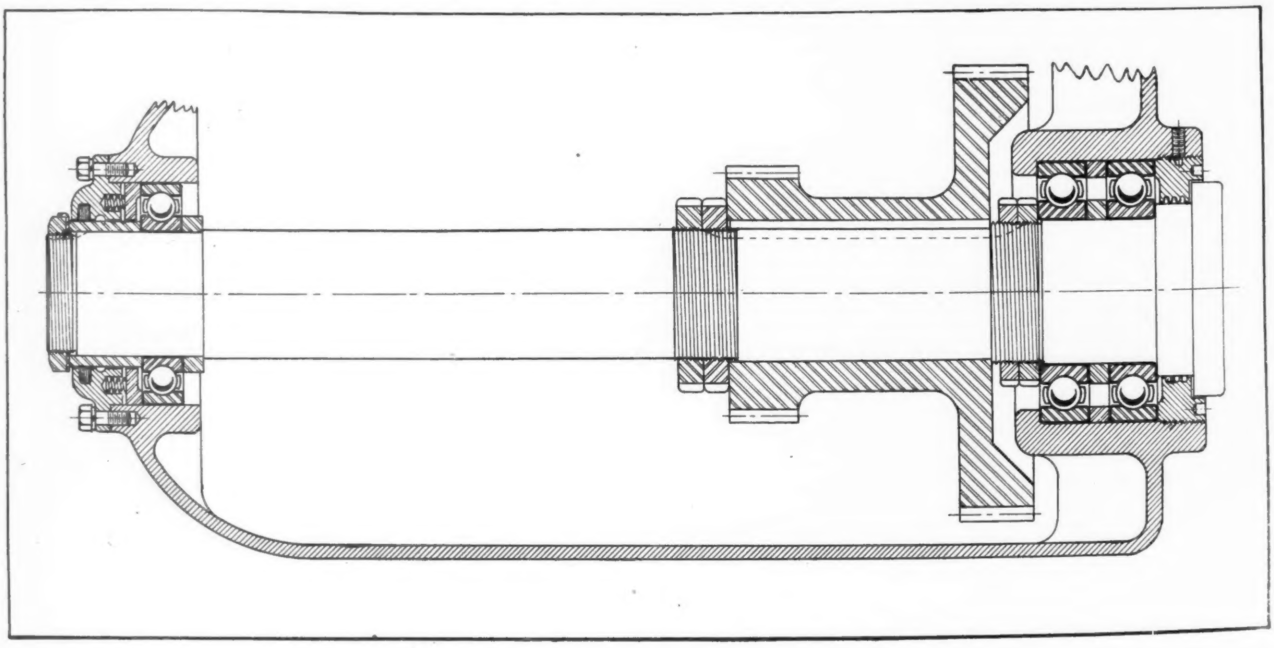


Fig. 8. Lathe Headstock Spindle with Three-bearing Mounting

the ball bearing, as a thrust resisting member, has an advantage over any other type of bearing, namely, that its angle of contact will vary appreciably to suit the load condition, and, therefore, nearly pure rolling motion can be obtained under all conditions of load and misalignment.

Three Types of Bearings

There are three types of bearings that are combined load carriers: First, the annular ball bearing, which is primarily designed for radial loads and has no angle of contact incorporated in its design, therefore having minimum thrust capacity (approximately 20 per cent of its radial capacity). Second, the one-direction angular contact bearing, which has a thrust capacity depending upon race design and the angle incorporated, which is generally made so that the thrust capacity is 100 per cent of the radial capacity. (This bearing, however, when used for combined loads, can only be used in pairs, and must have a threaded or shim adjustment incorporated in the mounting design to allow for initial adjustment.) Third, the double angular type bearing which is really two of the previously mentioned bearings built as a self-contained unit. The functioning of this bearing is not dependent on any exterior adjustment, and the angle of contact is generally such that it will sustain approximately 150 per cent of its radial capacity as thrust.

Contact Pressures

The fact that a ball bearing in operation has contact pressures in the neighborhood of 130,000 pounds per square inch absolutely prevents the formation of an oil film, and therefore, the bearing operates under metal-to-metal contact. This point, combined with the fact that in an angular contact bearing all the balls can be loaded, can advantageously be used in machine tools.

As an example, let us consider a high-speed grinding spindle operating at a speed as high as 30,000 revolutions per minute. Such high rotative velocities are prohibitive if straight annular ball bearings are used, due to the fact that under deformation, the balls on the unloaded side are not in contact with the rotating race, and therefore, excessive load is imposed on the separator or cage which spaces them. Also, the fact that the balls are not all in contact will allow radial motion or chatter to be set up.

However, if we use angular contact bearings, it is possible, by means of adjustment, to set up sufficient initial end thrust to keep all the balls in contact, thus relieving the separator of excessive load and at the same time preventing any possibility of radial clearance or chatter. Then the only problem left is to compensate for the expansion of the shaft due to any heat that might be generated. This is very readily done by mounting the bearings as shown in Fig. 7, in which the front bearings are positively locked for location, and the rear bearings allowed to float in a sleeve.

Applications of Angular Contact Bearings to Machine Tools

Another use of the angular contact bearing is in machine tool work-spindles, and again, in this case, the fact that a ball bearing operates under metal-to-metal contact can be used to advantage. To obtain satisfactory results on such applications as milling cutter spindles or grinder work-heads, it is only necessary that the bearings be chosen for this particular type of installation, and that they be set up under sufficient end thrust so that at no time will any of the balls be totally relieved of their load. The simplest way of obtaining these results is to mount two angular contact bearings next to the spindle, as shown in Fig. 8. It will be noted that there are spacers between the inner and outer races. These spacers are of different widths, the one between the inner races being wider than that used between the outer races, and as both inner and outer races are securely locked on the shaft and in the housing, it is obvious that the assembly is under end thrust, that should be sufficient to resist deflection under operating conditions.

The amount that the outer spacer is made narrower than the inner is determined by mounting the bearings on an arbor with the inner spacer in

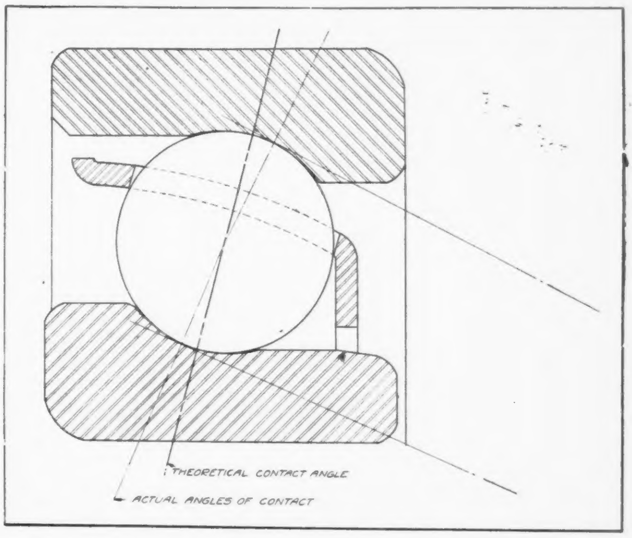


Fig. 9. Diagram Showing Contact Angle under Twice Rated Load

position. The outer races are then loaded under a known thrust load, and the separating distance measured. The outer spacer is next ground off to a similar dimension, and the bearings mounted. The rear end bearing is simply a single-row annular bearing, so mounted that slight end pressure is applied on it by means of springs, so there will be no liability of chatter or vibration being set up at this end.

* * *

OPPORTUNITIES FOR THE ENGINEER

In an address before a group of employes who have been in the employ of the Norton Co., Worcester, Mass., for twenty-five years or more, Charles H. Norton referred to the opportunities in the mechanical field during the next quarter of a century in the following words: "It may appear that there will never be another opportunity for developments in the mechanical field as great as there has been during the last twenty-five years; but I cannot believe but that the opportunity will be as great and that the machinery and methods of another twenty-five years will be as different from the machines and methods that we now have, as those of the present time are from what we knew twenty-five years ago."

Manufacturing Cutters for Gear Generators

Milling and Grinding Operations on Cutters for Gleason Machines

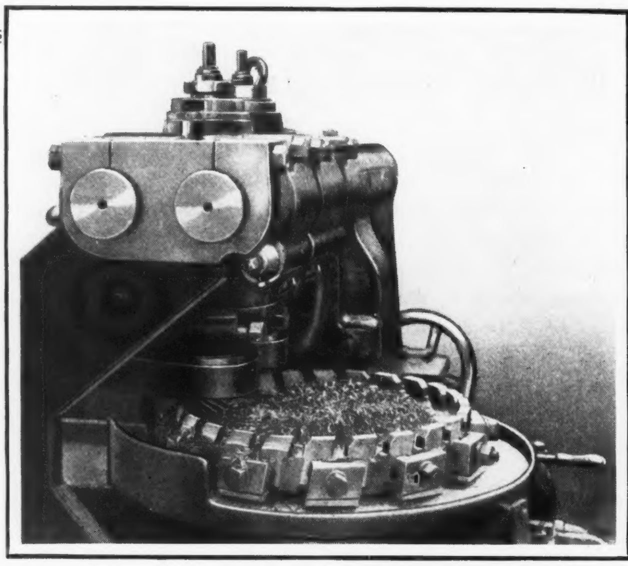


Fig. 1. Point-milling High-speed Steel Cutter Blades on a Quantity Production Basis

CERTAIN machine tools employ cutters that can best be produced by the builders of the machines. Hence, the sale of such machines often results in securing a permanent customer for the cutters. A considerable proportion of the business of the Gleason Works, Rochester, N. Y., consists of supplying cutters to previous purchasers of straight and spiral bevel gear generators and roughing machines and straight bevel gear planers. The volume of cutters manufactured has warranted the development of quantity production methods, the more interesting of which are here described.

Continuous Milling Operation on High-speed Steel

Cutter-heads used on spiral bevel gear roughing and generating machines consist of a circular plate having a number of cutter blades spaced equidistantly around the periphery, as shown in Fig. 3. The cutters used in roughing operations gash out the bulk of the metal between the teeth. Each alternate blade cuts on opposite sides of the tooth spaces; this method permits putting proper clearance shear and rake on the blades. On finishing cutters, the blades are so ground that one-half of them remove metal with the outside edge only, and the remaining blades with the inside edge only. The blades are, of course, alternated, an inside blade being followed by an outside one.

Most of the metal that must be removed from the cutting edges of blades for both roughing and finishing cutters is milled off in the operation illustrated in Fig. 1. Two spiral tapered cutters are employed, one of which mills the inside of the blades, and the other the outside. The taper of each cutter is such as to give the corresponding blade surface the desired angle. Each blade is seated at an angle from the vertical, in order to obtain the necessary clearance and relief of the cutting edges. Equalizing clamps provide for gripping or loosening two blades at each application of a wrench to one nut. In this operation of milling high-speed steel, a feed of 5.5 inches per minute is used, and a cutter speed of about 120 revolutions per minute. The production averages 140 blades per hour.

Grinding Spiral Bevel Gear Finishing Cutters

Three grinding wheels are employed on the machine shown in Fig. 2 for grinding the blades of cutters used on spiral-bevel gear generators. The cutter-head, with the blades assembled, is mounted, as shown at A, on an individually driven work-spindle. The work-spindle is contained in a reciprocating slide, which carries the cutter-head to and from the grinding wheels. At each return movement of the work-slide, the work-spindle indexes an amount equal to the distance from one cutter blade to the next. During that period of the forward stroke in which the blades are in contact with the grinding wheels, the work-spindle revolves sufficiently to carry the whole width of the blades across the wheels. This combined movement results in grinding the desired clearance and relief on the blade cutting edges.

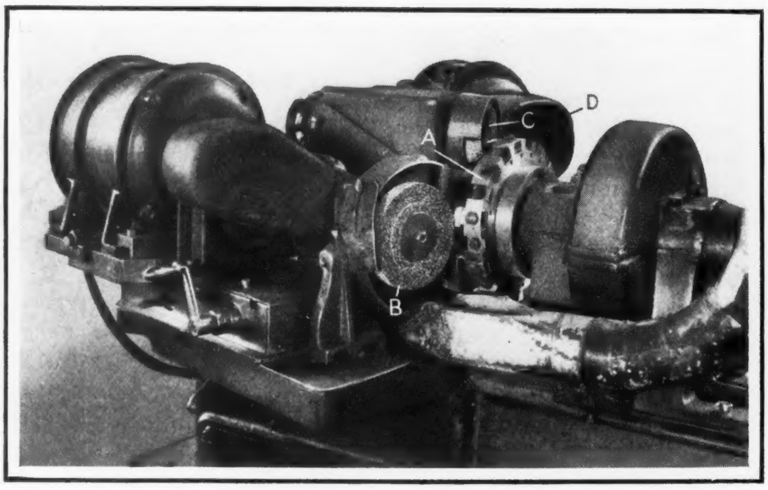


Fig. 2. Grinding the Blades of a Cutter-head for a Spiral Bevel Gear Generator by the Use of Three Grinding Wheels

Wheel B is employed for grinding the angular cutting surface of outside blades; wheel C for grinding the top of all blades; and the wheel of head D for grinding the angular cutting surface of inside blades. Because of the difference in the angles to which the alternate blades must be ground, two operations are required for grinding all the blades of a cutter-head. In one operation, all the blades

that cut on the outside are ground, and in the other all the blades that cut on the inside. The operation illustrated in Fig. 2 is the grinding of the outside cutting blades. Each grinding wheel has individual motor drive.

Adjustable Sine Bar Used in Checking Cutters

For checking the accuracy of the angular cutting edges of both outside and inside cutter blades, use is made of the adjustable sine bar illustrated in Fig. 3. These blade angles vary for different spiral bevel gears, but one-half the sum of the two angles always equals the mean pressure angle of the gear, whether this angle is 14 1/2, 17 1/2, or 20 degrees.

In the illustration, the sine bar is shown set up for checking cutters having a 14 1/2-degree mean pressure angle. Near the left-hand end, the sine bar *A* rests on a hardened and ground permanent plug or roller which extends through the fixture casting at *B*. Interchangeable rollers of different diameters may be mounted on stud *J* to support the sine bar at the proper angle for each size of cutter-head. A number of these interchangeable rollers are shown lying on the bench.

For inspecting, the cutter-head is seated with its bore on an accurate disk of the sine bar fixture. This disk may be easily revolved to carry each cutter blade past the feelers of bars *C* and *D*. These bars are identical, and are lowered and raised by similar mechanisms, bar *C* being employed for checking inside blades, and bar *D* for outside blades. Lowering and raising of each bar is accomplished by applying the square socket of disk *E* to the shank of the corresponding pinion *F*. This pinion engages teeth cut along one edge of the sliding bar and moves the bar up and down between two rollers and an adjustable block.

The feeler of each sliding bar is mounted in the lower end of a lever *G*, the upper end of which is connected to the spindle of dial indicator *H*. Thus, as the various cutter blades are checked by sliding the feeler over them, any inaccuracies are immediately registered on the dial indicator. This indicator is graduated to 0.0001 inch.

Grinding the Profile of Roughing Cutters

In a special machine built by the Gleason Works for roughing straight bevel gears in large quantities, a cutter-head about 20 1/2 inches in diameter is revolved centrally with three work-holding spindles to rough out three gears at a time. The cutter-head is of the general design shown at *A*, Fig. 4, being provided with about two dozen cutter blades. The illustration shows the profile of these blades being ground on one side by a form wheel.

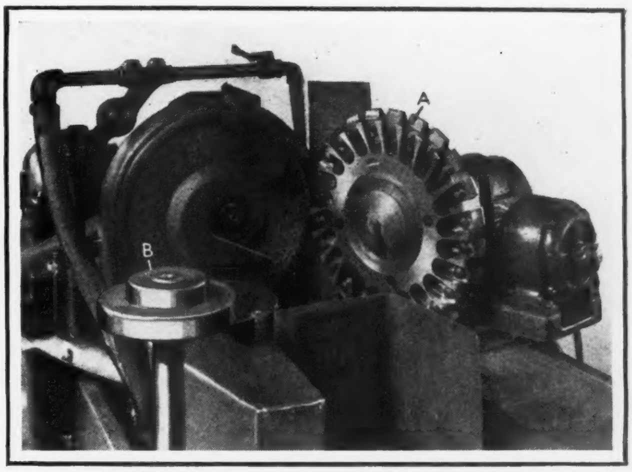


Fig. 4. Grinding the Profile of the Blades of Large Circular Cutters Used for Roughing Straight Bevel Gears

In operation, the work-head of the machine is inclined at the desired angle relative to the grinding wheel. The work-head is then positioned as shown, and the blades ground as they are revolved in contact with the rotating grinding wheel. After the blades have been ground on one side, the cutter-head is reversed on the work-head spindle for grinding the opposite sides of the blades. The periphery of the grinding wheel is, of course, dressed to suit the desired radius of the blade profiles. Truing of the wheel is accomplished by means of a special device. Maximum production is obtained in this operation by having the operator assemble the cutter blades on a head while those of another head are being ground. The assembly of the cutter blades is facilitated by mounting the cutter-head on the rotatable top of stand *B*.

How Cutters for Straight Bevel-Gear Generators are Ground

Four surfaces of the cutters employed on straight bevel gear generators are ground by merely positioning them differently on a magnetic chuck of the type shown on the horizontal surface grinding machine illustrated in Fig. 5, and then traversing this chuck beneath the grinding wheel. As shown at *A*, various surfaces are machined in the chuck to permit holding the cutters at the necessary angles for grinding them to the desired shape. Surfaces *B*, *C*, *D*, and *E* are ground on this chuck, while the top and bottom of the cutters are ground on another chuck. Fourteen cutters of the size here shown can be positioned along the chuck to be ground in one operation. Some chucks are built to receive two rows of cutters.

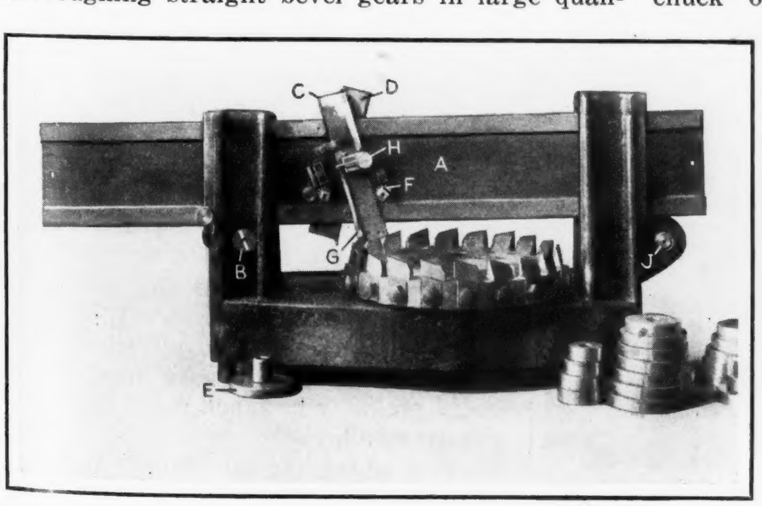


Fig. 3. Adjustable Sine Bar Used for Inspecting the Cutter-heads for Spiral Bevel Gear Generators

Feeding Work Automatically from a Surface Grinder to a Washing Machine

Cutter blades, shims, washers, and other parts having parallel flat surfaces

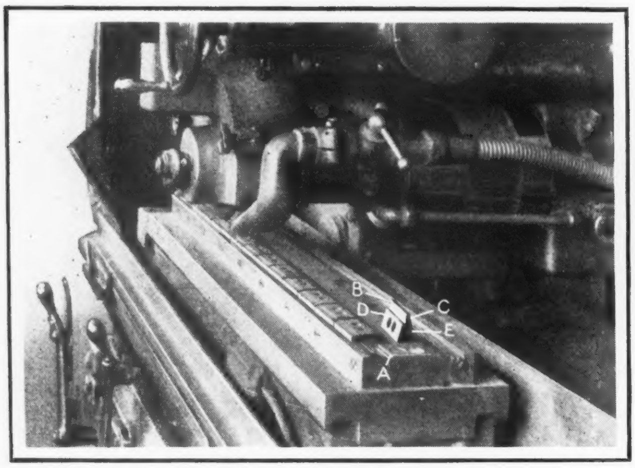


Fig. 5. Magnetic Chuck Used in Grinding Four Different Surfaces of Straight Bevel Gear Generator Cutters

that must be accurately ground with respect to thickness are handled on the vertical surface grinding machine shown in Fig. 6. This machine is provided with an automatic feed, which compensates for wear of the grinding wheel, and over a quantity of, say, three thousand parts, the variation in thickness is not more than 0.003 inch. The operator stands in the position illustrated, and places the parts on a revolving magnetic chuck.

After the parts pass from under the grinding wheel, the current is shut off from the chuck, and the work slides off the chuck, through demagnetizer *A* and on the revolving table *B*. They are carried by this table to the conveyor of a washing machine *C*, and when they reach the opposite end of the washing machine they are thoroughly cleansed, ready for use.

* * *

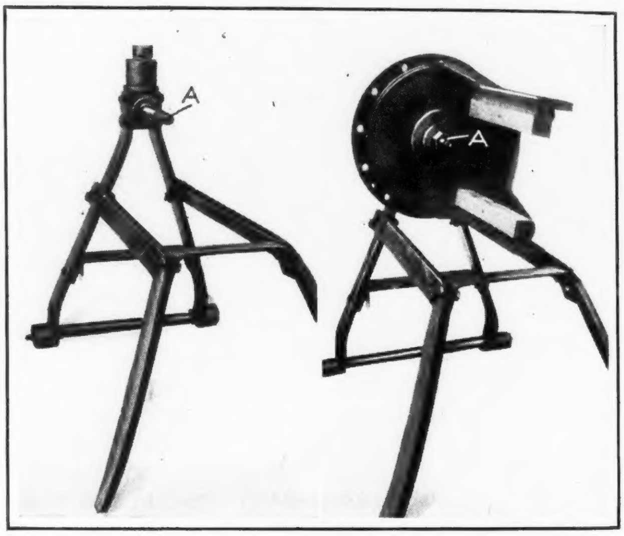
Czecho-slovakian machinery dealers have, according to Consul General C. S. Winans of Prague, organized as a special section of the Central Merchants Association of Czecho-slovakia. A large proportion of the machines and machine parts imported into Czecho-slovakia are now obtained through export houses in Berlin and Vienna, and the Czecho-slovakian machinery dealers will endeavor to bring about direct importation of machinery from the countries of origin.

Fig. 6. Arrangement Employed for Automatically Carrying Cutter Blades, Shims, Washers, etc., from a Vertical Surface Grinding Machine to a Washing Machine

RACK FOR BACK VALVE CHAMBER HEADS

By J. R. PHELPS, Atchison, Topeka & Santa Fe Shops, San Bernardino, Cal.

The guides on back valve chamber heads require some hand work, such as scraping the planed surfaces, and anyone who has ever rolled these heads around on a bench and attempted to work on them will appreciate the special holding rack to be described. At the left in the illustration is shown the rack without the work in place, and at the right, is shown a valve chamber head bolted in position on the central stud *A*. The head can be turned about the stud to locate the guides either vertically or horizontally, as may be desired. The distance from central stud *A* to the floor is 38 1/4 inches. The legs beneath the work-holding end are provided with 3 1/2-inch wheels or rollers, so that the rack can easily be moved about. This



Empty Rack at Left, and Rack with Valve Chamber Head in Position at Right

rack was designed and built by H. C. Moore, valve gang foreman at the San Bernardino Shops of the Atchison, Topeka & Santa Fe Railway.

* * *

Comparatively little progress has been made thus far in the application of alloy steels to locomotive and railroad car construction, although their use has been under consideration for a long time. The use of alloy steels would permit the weight to be reduced, the same as in automobiles; or if a reduction of weight is not necessary or desirable, then greater strength would be afforded, giving a higher factor of safety, with resulting increase in life and reduction in maintenance cost. Doubtless the future will show many new applications of high-grade steels of this kind in railroad construction. Passenger cars, particularly, could probably be made much lighter by the use of alloy steels, thereby decreasing the cost of hauling the trains. In places where there are heavy grades, this would, of course, be of considerable importance.

Wire Forming Applied to Ring Manufacture

By F. SERVER

Among the incidental jobs encountered in nearly every factory is the making of rings as a part of some device. The production of these rings is often a very troublesome problem, particularly when it is not approached in a correct manner. In the accompanying illustrations are shown a number of dies that have been used successfully for cutting off, bending, and forming wire into rings.

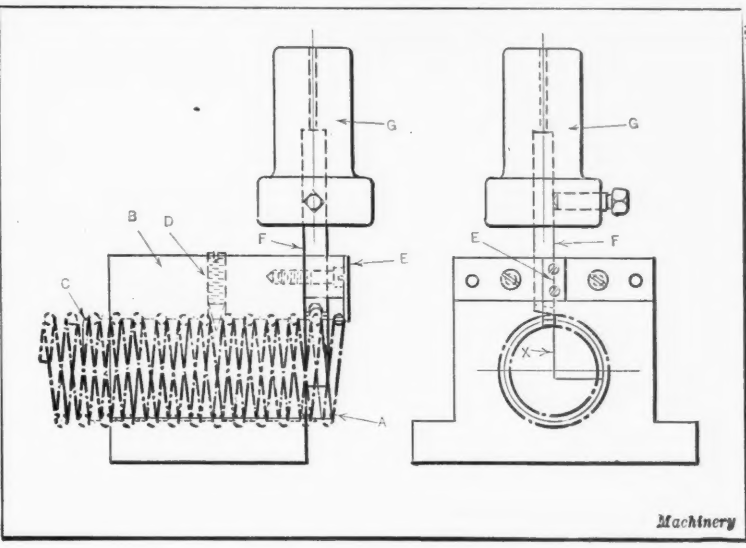


Fig. 1. Die for Cutting off Rings from Coil

Cutting off Rings from Coil

In Fig. 1 is shown a die that cuts off rings from a coil *A*, which has been previously wound in the form of a spring. These rings are afterward placed in the die shown in Fig. 2, which closes the joint and bends the ring into shape. The cutting-off die shown in Fig. 1 consists of a block *B* with a hole through the center which has a threaded groove conforming to the helix of the spring. In this hole is placed a round arbor which also has a groove cut in its outer periphery to conform to the inner helix of the spring. Screw *D* holds the round grooved arbor in position, so that the coil spring *A* will pass through the groove when screwed in from the left-hand end until the right-hand end comes against a stop *E*, which is attached to the end of the die. The end of the guiding arbor is cut away, so that it forms an edge *X* against which the cutting-off tool *F* shears off one coil of the spring at each stroke of the press.

Cutter *F* is clamped in a holder *G* which, in turn, is attached to the ram of a foot press, and its lower edge is grooved to conform to the radius of the wire. In using this die, the operator merely screws the coiled wire into the die until the end comes against the stop, and then trips the press. As the cutter descends one ring is cut off. The spring is again screwed in until the end comes against the stop, and at the same time, the ring previously cut off is removed if it does not fall off. Then the cutter descends and cuts off another ring. This operation is repeated until the end of the spring is almost reached, following which another spring is threaded into the die. The new spring pushes out the short end of the preceding spring.

Die for Aligning and Closing Ends of Ring

After the required number of helical rings are cut off, they are next placed, one at a time, in the die shown in Fig. 2. The ring *A* is placed over a mandrel *B* in approximately the position shown. A conforming ring *C* in the holder *D* of the ram then descends, and the ring is forced over the mandrel *B* into the position shown at *A*, where it is pressed against a form *E*, which gives it the desired symmetrical ring shape with a closed joint.

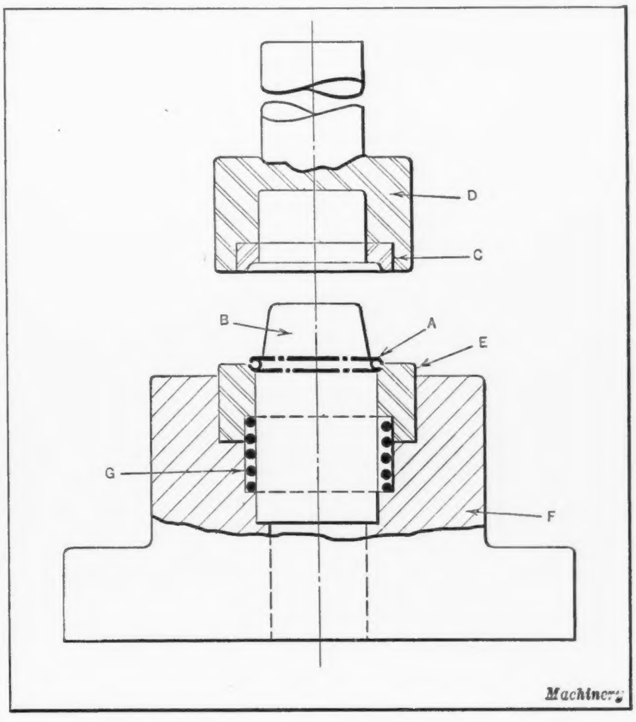


Fig. 2. Die for Aligning and Closing Ends of Ring

The lower conforming ring *E* is placed in a holder *F* which, in turn, is attached to the bolster plate of the press. A spring *G* is compressed by the conforming ring *E* as the punch descends. After the conforming operation is completed and the punch goes up, spring *G* causes the conforming ring *E* to strip the work *A* off the mandrel *B*, thereby raising it slightly above the position shown, so that it can be flipped out of place with a sharp pointed instrument, following which another ring is put in position. The tools shown in Figs. 1 and 2 are adapted for making small rings in moderate quantities.

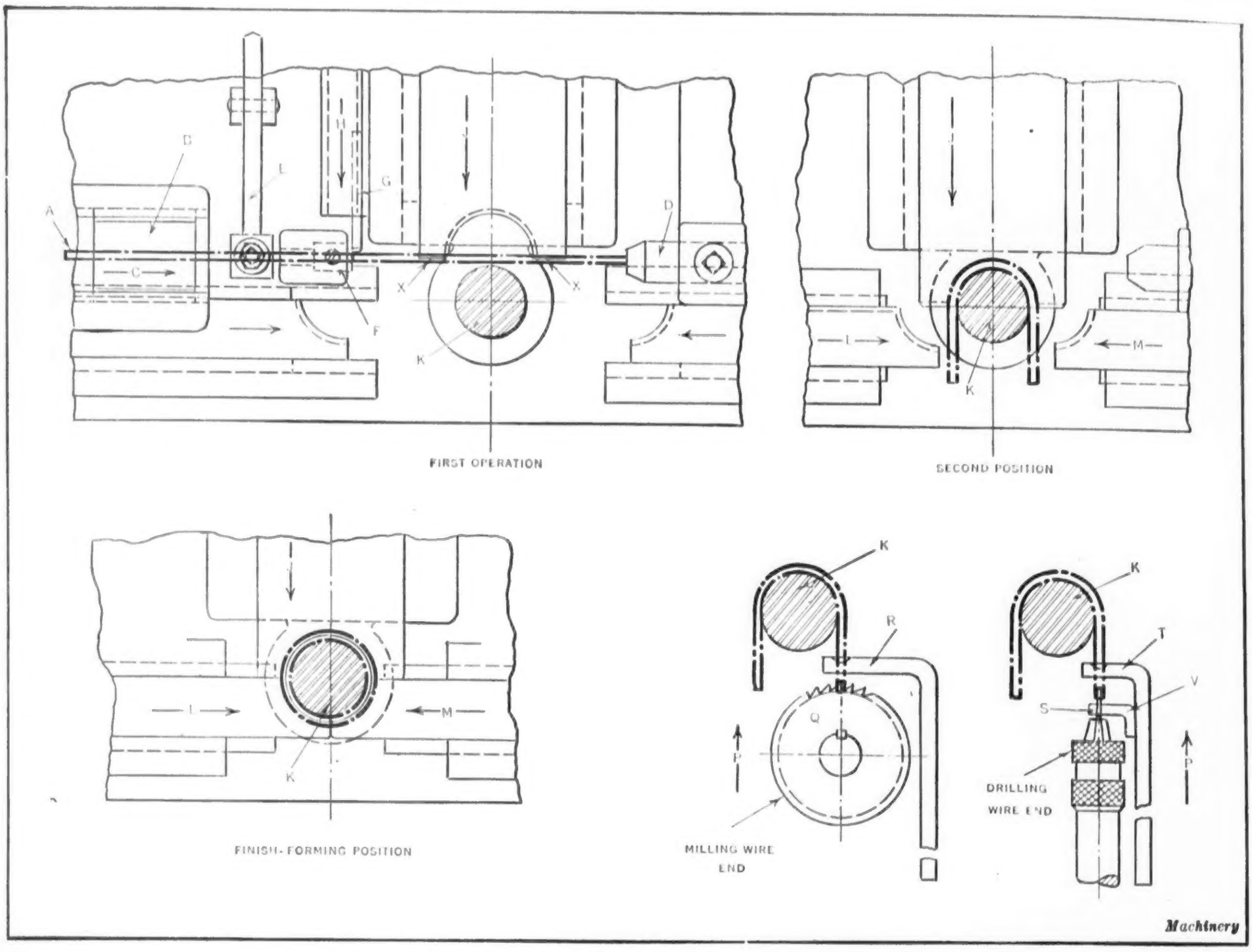


Fig. 3. Automatic Slide Type of Ring-bending Equipment

The tool equipment of a slide-operating machine for automatically forming rings is shown in Fig. 3. In this machine, rings are formed from wire by a series of forming dies, which successively bend the work at different points to form the complete ring. The wire *A* is taken from a reel and passed through a series of straightening rolls at the left—not shown. The slide *B* then clamps the work and feeds it in the direction of the arrow *C* until it comes against the stop at *D*, in which position it is clamped by a rocker arm *E*, so that it can be released by the slide *B*. The rocker arm then returns and grips another piece, ready to feed it along after the forming operations have been performed on the first piece.

The wire, as it is fed forward, passes through a bushing *F*, which acts as a die for the cutting-off tool *G*, the slide on which the tool is mounted being operated in the direction of the arrow *H*. Previous to this cutting-off operation, the circular shaped form tool advances in the direction of the arrow *J*, and just comes in contact with the work at *X*, so that it is held against the arbor *K*, shown in cross-section. This is the first operative position preliminary to the forming.

At the second position, the slide *J* is advanced, so that the work is formed to the shape shown on the arbor *K* in the view illustrating the second position. The slide *J* then dwells in this position while slides *L* and *M* feed toward the center of the arbor *K* in the direction indicated by the arrows, to complete the forming of the ring as shown by dot-and-dash lines in the view in the lower left-hand corner.

The slides *J*, *L*, and *M* then return to their starting positions, as shown in the first-operation view, while the arbor *K* recedes and allows the ring to drop out of the machine, following which another piece of wire is fed against the stop. Briefly stated, the operations on this forming machine consist of feeding the wire against the stop; clamping the wire and cutting off; forming the U shape; and forming both ends to bring the work to the shape shown by the finish-forming position in the lower left-hand corner.

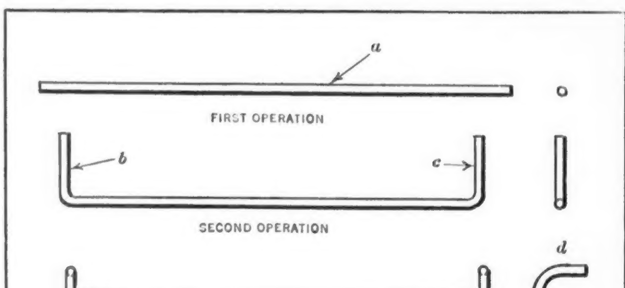


Fig. 4. Sequence of Operations in Forming Wire Piece

Combining Machining and Forming Operations

A particularly good feature of this type of machine is that certain incidental operations can be performed on it when necessary. The equipment for two such oper-

ations is shown in the two views at the lower right-hand corner of Fig. 3. The operations are performed with this equipment while the work is in the shape shown at the second position, or in other words, while it is clamped by slide J against arbor K. In the first operation, a slide feeds forward in the direction of the arrow P, carrying a milling cutter Q, revolving to the right, which mills the end of the work. During this operation the work is supported by a guide bar R, which is also mounted on the slide. After the work is milled to the required depth, the slide returns to its original position.

To the right of the milling equipment is shown a drill S performing the operation of drilling a small hole in the end of the formed work. The work is supported in a bar T to which is attached a drill piloting angle V, which acts as a guide for the drill. The machine operates in the same manner as for the operation just described. This slide type of machine is automatic in action, and it may be used for such jobs as forming half rings or circular parts with shapes on their ends, although certain modifications of the forms and slide would be necessary.

Die for Forming Ring Segments

A very simple die that can be used for making ring segments is shown in Fig. 5. It consists of a base A which is attached to the bolster plate of the press, a steel block B, mounted on the base and attached to it by screws which are not shown. To the side of this block is attached a hardened steel plate C. Wire is fed through the block B around a curve X, and pushed in the direction of the arrow D by means of feeding rolls or a feeding slide until the end of the work comes against the surface Z of block B, which acts as a stop. A cutter E, attached to the holder F by means of the screw G, then descends and cuts off the ring segment. The segment falls out of the machine, and the wire is again fed forward around the curve, after which the operator trips the press and makes another ring segment. Block B is made in two half sections, being parted on the center line of the wire, as indicated at H so that the shape X can be cut in it; the two half sections are then screwed and doweled together to make one block.

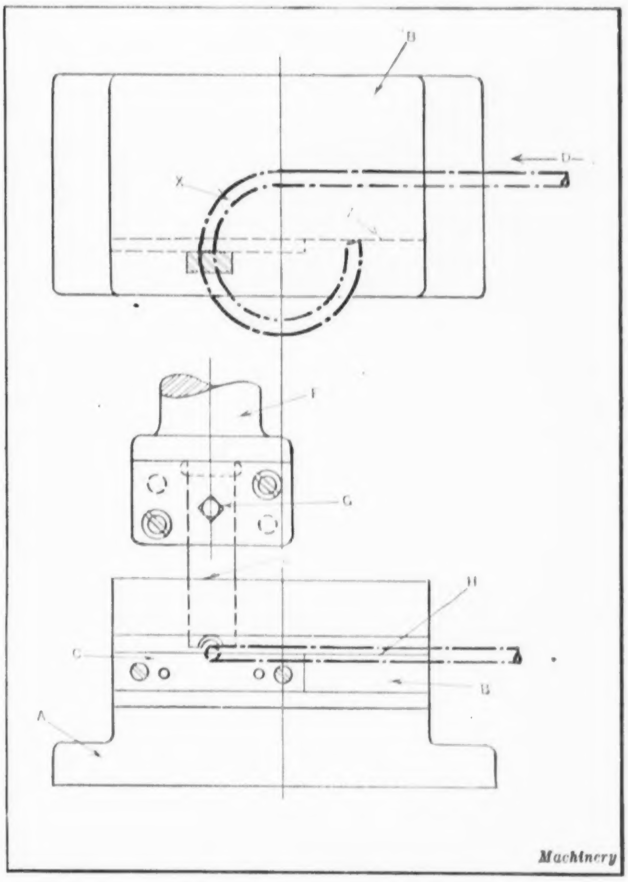


Fig. 5. Die for Forming Ring Segments

Forming Both Ends of Wire Piece Simultaneously

The operations shown in Fig. 4 are performed on a machine embodying the features shown in Fig. 6. The general principle of operation of this machine is based on slide units similar to those shown in Fig. 3. The wire X, Fig. 6, passes through straightening rolls as it comes from a reel, and is fed out to the length a, Fig. 4. It is then cut off by cutter A, Fig. 6, and clamped in place by the slide block B, which is fed upward until it clamps the wire against the stationary formed block C. The blocks B and C have grooves cut in them to conform to the shape of the wire. The two end forming plungers D and E are fed in the direction

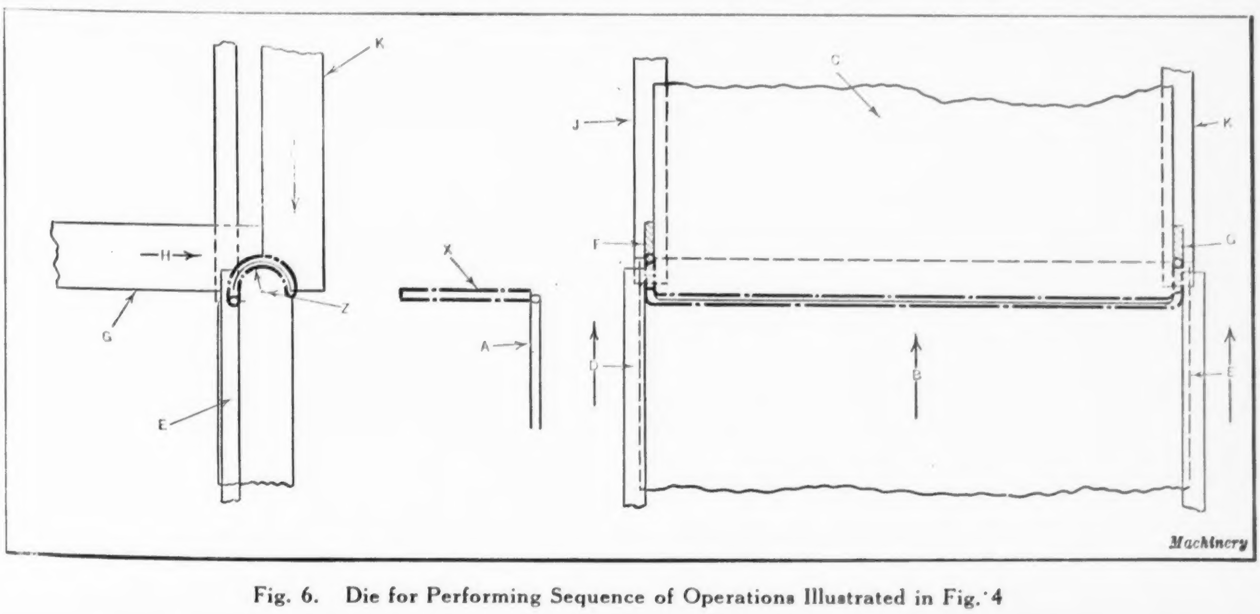


Fig. 6. Die for Performing Sequence of Operations Illustrated in Fig. 4

of the arrows, so that they bend over the ends of the wire to the shape shown at b and c, Fig. 4.

An integral part of the formed block B, Fig. 6, has a section formed to the radius Z which, of course, advances as the block B moves in and clamps the part in the position shown. After bending the ends of the work, two plungers F and G, advancing as indicated by arrow H, bend the end of the wire over, producing the shape shown at d, Fig. 4. After this, two slides J and K, Fig. 6, advance from the back in the direction of the arrow L, thus producing the finished piece shown at e, Fig. 4. All of the slides then return to their initial positions, and the same series of operations is performed on another piece of wire. The slides on the machine described are operated by cams and levers, the same as on wire forming machines, the chief requirement being sufficient rigidity to set the wire so that it will retain its shape after being formed.

* * *

IMPRESSIONS OF A VISITOR IN GERMANY

By HENRY SIMON

During a stay of three months in Germany, the writer's general impression in regard to the German metal-working industries is that, badly handicapped though they are, they are slowly recuperating. It would be wholly erroneous, however, to infer from this statement that good times are near or even in sight, as is now and then asserted by travelers who know neither the people nor the country. Unemployment is still widespread, and although it has been reduced considerably in past months, there are still, at the present writing, about a million and a half unemployed, drawing a government dole. In a recent inquiry into the conditions prevailing in the machine-building industry, 75 per cent of the firms reporting complained of insufficient business; and it was estimated from the reports that industry as a whole was working at only 55 per cent of capacity.

Figured in gold marks, wages are higher than in pre-war times, but the cost of living is far in excess of the increase in wages. The adverse differential in the status of the average industrial worker was given by one authority interviewed by the writer as about 25 per cent. This means that the workingman, by stringent economy, is able to exist, but to save little or nothing.

A bad situation prevails in regard to housing, and many families still have to live under crowded and unfavorable conditions, although there has been an improvement in the past year, due to increased building activity. All the necessaries of life are to be had, but many of them are still very high. Meat and butter are sold at American prices, and are therefore very expensive from the viewpoint of the German worker, who receives, say, \$10 or \$12 a week, where the American doing the same work would get about \$30. Clothing and shoes are cheaper, though still high when judged from the standpoint of the man who has to earn his living here. Bread and potatoes are to be had at about one-third to one-fourth of American prices, but fruit and vegetables, though lower in dollars and cents, seem very high. Of that cross-section of German industrial life which the writer has had the opportunity to observe, it may be said that by rigid thrift, by doing without luxuries, many of which are looked upon as necessities in the United States, and by living on an exceedingly modest scale as to food and clothing, the German worker manages to bring himself and his family through decently.

The manufacturer is in an analogous position. He is just able to get along. Foreign business is generally poor, due largely to high tariffs and partly to other discriminatory measures taken by foreign countries, against business of German origin. I am informed that in Great Britain, a rule forbidding branches of German business houses from employing members of their staff other than executives from Germany was only recently revoked, and several of the principal countries still adhere to similar rules, making it difficult to operate a branch office. Money is tight, and even the best firms cannot borrow at a rate of interest less than 8 1/2 per cent. Foreign capital is difficult to obtain, and collateral three times the amount of the loan is demanded.

One who knew Germany well before the war and sees it now, gets the broad impression that this country is earnestly engaged upon the task of minding its own business, and this seems true also of German industry. Employer and worker both apparently realize that everybody must do his part, and that this is not the time to engage in disputes. All the same, great differences exist. The employer is not able to forget the "riding" to which he was subjected by the workers in the years following the revolution, and this feeling is not helped by the realization that soviet organizers are still busy in his shops. The worker is dissatisfied with his earnings.

This seems to be the day of the introduction of efficiency systems of a type now largely obsolete in America, and a great deal of resentment seems to arise among the workers from this source. The relations between employer and worker can therefore hardly be termed happy, although on the other hand, they do not appear to be in danger of being seriously strained, and it does not look as if either party would be inclined to rock the boat.

In the present state of things in Europe, industrial conditions are dependent upon the political situation in a way that we do not realize in America. There can be no question that the republic is here to stay and that behind it are united the great mass of workers as well as intellectuals, no matter how widely their interest may differ. German industry has a hard task ahead of it; but it looks as if it were building on a sound foundation.

* * *

The third World Motor Transport Congress was held at the Hotel Roosevelt, New York City, under the auspices of the National Automobile Chamber of Commerce, Monday and Tuesday, January 10 and 11, coincident with the Automobile Show. Representatives from a great number of foreign countries were present, and addresses were made by speakers from Great Britain, Germany, Austria, Switzerland, Lithuania, Colombia, and Mexico.

The British Metal-working Industries

From Machinery's Special Correspondent

London, January 19

THE new year finds business engaged in the difficult task of piecing together the threads of trade severed by the deplorable events of the last seven months. It was not until December that the resumption of work by the miners began to restore to industry its most essential raw material, and probably another month must elapse before there will be an approach to normal conditions in respect to prices and supplies of, not only coal, but also iron and steel.

Iron and Steel Industries Have Had Heavy Losses

In the iron and steel and heavy engineering industries, arrears of work are great, and the accumulation of orders will provide, in some cases, full employment for several months, but optimism in regard to the future must be tempered by the knowledge that the new year has inherited from the old a heavy legacy of loss which, although distributed unevenly among the various branches of industry, remains a severe handicap to British commerce. Another loss that will be felt for some time is the large number of contracts that have gone to the Continent for iron and steel.

The recently published accounts of some of the large iron and steel companies show how serious their losses have been, but these things are now of the past, and although there will be many reminders this year, it is a consolation to know that the year opens with their order books so well filled that when raw materials are in good supply, works should be busy for some months ahead.

Demand is Increasing in the Machine Tool Field

Inquiries for machine tools are naturally more numerous now than in the latter part of last year, and they will no doubt increase as soon as business gets into its full stride after the holiday period. Inquiries from overseas form a large proportion of the total at the moment, especially from the Indian and Colonial railways and also from the Crown Agents for the Colonies; in fact, it is believed that these will be the chief source of orders for some time.

Automobile manufacturers are now settling down well to their 1927 program, and are placing a fair number of orders for machine tools. More and more attention is being paid to special and semi-special machines, this having been a notable feature during the past year. Automobile manufacturers are intensively progressive, both in the design of their product and in their manufacturing methods, and they have certainly done a great deal to keep the British machine tool maker fairly busy during the last nine months.

Exports Decrease Slightly—Imports Increase

The exported tonnage of machine tools fell a little in November, the figures being 952 tons, with a value of £118,230; the ton value rose considerably, from £114 to £128. The value of small tools and cutters exported in November rose to £60,830, an increase of nearly £7000 over the October figures. This brings the year's monthly average to £53,471 over the eleven months.

The tendency over the year is to maintain a tonnage level of machine tools of about 2 per cent below last year. The total values, however, are about the same as last year, thus indicating a slight hardening in machine tool prices. The improvement in tools and cutters maintains the trade during a year of disturbed conditions.

The machine tool imports for November amounted to 982 tons, valued at £94,446, representing a ton value of £96. This is the highest imported tonnage on record (except war months), bringing the tonnage for this year up to 241 tons for every 100 tons imported in pre-war years. The rise has been steady for about eighteen months, with an equally steady decrease in ton value.

From the classified exports for October, the last month for which records are available, it appears that lathes were still the best sellers, accounting for £42,758 of a total of £138,671. Drilling machines were exported to the value of £26,035, planers and shapers accounted for £17,225, milling machines for £10,799, and grinding machines for £8903.

The General Engineering Fields Report Improvement

Constructional engineers are now hard at work making up arrears, for they have all been seriously handicapped by the shortage of steel. Electrical engineering is flourishing, a number of important contracts having been placed recently. One of these is for the complete electrical equipment of the passenger service on a large section of the Southern Railway suburban system.

Textile machinery shows some signs of improvement, especially artificial silk machines. Makers are satisfied with the present situation and optimistic about the future. The coal stoppage ended too late to give hardware manufacturers much chance to recover before Christmas, but the outlook is now bright.

Prospects are Bright in the Shipbuilding Industry

The shipbuilding industry has also very bright prospects. There is more work on hand than at any time for several years past, but no accurate estimate can be made of the total. The tonnage of vessels booked but not yet laid down must be substantial, and although a large proportion of it dates from before the coal stoppage, the majority has been booked within the last eight weeks.

Generally, the prospects for the metal-working industries in 1927 are splendid, and, in most branches, far better than a normal return to business conditions would warrant.

Current Editorial Comment

in the Machine-building and Kindred Industries

PATENT OFFICE NEEDS

Many of the valuable records of the Patent Office are stored on wooden shelves to which fire might cause irreparable damage. Beyond question these records should be protected by metal filing cabinets and racks. The cost would be small.

The Patent Office finds it difficult to retain an experienced staff of examiners, as their salaries are lower than those paid to men of similar experience and training in the industries. The Patent Office therefore constantly loses many experienced examiners from its staff, and finds it difficult to fill their positions even with young men just out of college, many of whom regard the Patent Office as a training school for some vocation that pays better.

A staff consisting largely of inexperienced examiners is a serious matter to the mechanical industries, as many of their products have been built up to a considerable extent upon patent rights. The inexperienced examiner is prone to pass favorably on patent applications that may cause expensive litigation later. It is of great importance to our industries that the Patent Office receive sufficient appropriations for its urgent needs.

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SALVAGING BY ELECTROPLATING

We do not generally think of electroplating as a machine shop operation for producing machinery parts true to size, but recent developments in the electrical field indicate that this method may become very useful for the purpose referred to. For some years one of the large electrical companies has reclaimed worn parts, or parts machined to too small dimensions, by means of the electro-deposition of iron. This method has been used also for building up shafts, pins, bolts, spindles and similar parts to their original dimensions after they have been worn to such an extent that otherwise they would have to be scrapped. It has been suggested that with very little modification the process can be developed to build up the worn inside surfaces of automobile engine cylinders.

This method was first used during the World War, when the British restored worn automobile and airplane parts by electro-deposition. In one instance, 6000 worn parts were restored, and it was said that the restored parts served as satisfactorily as new ones. The operation is not very complicated, does not require an elaborate chemical or electrical equipment, and can be performed by any shop man of average intelligence.

The process has been in use for several years in the plant of one of the large electrical companies, and while publicity has been given to the methods used and the results obtained, its general application has been retarded because its possibilities are not generally known. Any large machine shop that frequently scraps parts because they are machined under size, or any shop that does considerable repair work where worn parts could be restored by adding a thin layer of metal, could use this method to advantage.

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WELDED FRAMES REPLACE CASTINGS

The use of welded as a substitute for riveted joints has been the subject of much discussion. Undoubtedly there is a great future for the various welding processes, and they will find constantly broadening fields of application; but a number of problems must be solved before welding becomes a generally accepted method of construction as a substitute for riveting.

None of the objections raised to the new processes when applied to building, ship or boiler construction, apply when welded designs take the place of castings. Then welded constructions have all the advantages. All the leading electrical companies have used electric arc welding in the construction of machinery frames, some of which have been of complicated design and huge proportions.

The advantages claimed for welded frames over those made from cast iron are greater strength and dependability, reduced weight and less cost. The saving is especially noteworthy when only one or a few large castings are required, because the cost of the pattern is avoided. One objection often raised to the use of welded machine frames and bases is that they do not have the finished appearance of castings; but even this objection can be overcome by more care in designing the parts to be welded. Several of the electrical companies have been very successful in constructing machine frames by welding that compare favorably in appearance with those made from castings.

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SAFETY ENGINEERING IN COLLEGES

A successful machine must not only be efficient; it also must be safe to operate. If not, it fails to meet one of the important requirements for which provision should have been made in its design. Particular emphasis should be placed on this point in the machine design courses in all engineering colleges. The students should be given definite instruction in safety engineering, and should be made to realize that it is as much a part of the work and duty of an engineer to provide safe working conditions as it is to provide machines that produce efficiently.

Instruction in safety engineering can be effectively introduced in the courses in machine design, shop practice and industrial management, and the subject of safety in the industries should be presented to the student as a matter closely related to successful engineering rather than as a mere humanitarian subject.

Progress in Machine Shop Practice

Report of the Shop Practice Division of the A. S. M. E.

IN its report to the American Society of Mechanical Engineers, the Machine Shop Practice Division of the society, of which W. F. Dixon, works manager of the Singer Mfg. Co., was chairman during the past year, states, that in describing the progress made in machine shop practice during the past year, consideration must be given to two groups of engineers—the equipment builders and the equipment users. The work of the builders of new and better equipment has been important, and any one interested has only to read the various trade journals to be convinced of the significant engineering advances made by this group of men. A considerable amount of the progress made in developing manufacturing methods and equipment, however, is due to the engineers employed by the users of shop equipment.

A careful analysis of the shop operations and equipment of many metal-working shops and factories will disclose that their standard machines are fitted with special attachments, jigs, fixtures, and tools designed by the users. In fact, many shops will be found where a very large percentage of the machine tools used are entirely special, having been built by the shops using them. Most of this progress is little advertised, and therefore, generally unknown, but its effect on industry is great.

Tendencies in Machine Tool Drives

There are certain tendencies shown by most of the new machinery brought out by the machine tool builders. Motor drive has increased in popularity, and practically every machine shop tool built today has motor drive—at least, as optional equipment. In some cases, motor drive is standard and countershaft drive special, while in others, motor drive only is furnished. Motors are applied not only to the larger units, but also to the smaller machines, such as small drills, tappers, etc., requiring fractional-horsepower motors. Motors are more and more being designed into machine tools rather than "tacked on" as an afterthought. Certain lathe makers, for instance, list three distinct types of drive, none of which can be readily changed to the other: First, the familiar countershaft-driven cone type; second, the countershaft or lineshaft single-pulley type; third, the motor-driven type, with motor in the leg. In some machines, motors are built directly on the spindles, or geared directly to them, and several motors are applied to one machine.

There is still plenty of room for improvement, however, in the details of some of these motor-driven machines. More attention could well be paid to wiring. Metal piping should be used wherever possible, instead of BX and loom coverings, and where motors are placed on moving slides, great care should be taken to prevent chafing. This is particularly true where oil and cutting lubricants are present and a comparatively high voltage is used. Further, where motors and controls are at all complicated, a clear wiring diagram for the complete system should accompany the machine.

Bearings, Lubrication, and Control

Another tendency in machine tool manufacture has been toward better bearings. Ball and roller bearings are being more and more employed. Having first been used successfully on intermediate shafts, their application is extending, and now they may be found on the main spindles of several precision machines. An equally important improvement has been made in lubrication. Flood lubrication by pump or splash is the rule in the best grade of lathes, milling machines, etc.

Control is another important branch of development. New models of machine tools prove that considerable thought has been given to ease of control and facility in chucking or feeding. Fast table movements on milling machines, treadle control of work-heads on grinders, push-button control, pneumatic and hydraulic chucks and vises, automatic mechanical chucks, and the bringing together of all control handles within easy reach of the operator all show this tendency.

Special Machines and Attachments

Another growing tendency is shown by the increasing number of purely special machines being built. First, the builders of standard equipment are employing no little ingenuity in fitting their machines with attachments particularly adapted to do some one special job. Second, a great many purely special machines are being built. Examples of this are the multi-spindle drilling machines and multi-head millers built for the automobile trade. In some instances, these machines, while entirely special, employ standard beds, heads, and parts—which makes for great economy in their construction.

Hydraulic feeds have been utilized by several designers of new machinery. In some cases the power is supplied to the hydraulic cylinders in the machine by oil under pressure from an accurately controlled pump. Drilling and milling machine feeds, broaches, honing machines, and a variety of special machines have lately embodied this feature.

Quite a complete line of precision measuring apparatus has been placed on the market during the past year. Most of this apparatus utilizes optical multiplication of some sort. There is a growing use of precision measuring equipment in this country, and great strides have been made in adapting what was formerly laboratory equipment to the shop, and putting it to work there. Such equipment is available with which it is possible to make measurements correct to one-fourth of a ten-thousandth of an inch, or even closer.

The honing of bearing surfaces is gaining in favor, especially in the automobile factories, where

cylinders are being honed on improved machines, and wrist-pins are lapped to close limits and a mirror finish by machinery. Machinery for grinding gears has been improved, and the use of the ground gear is being extended. At least two machines for the accurate boring of jigs have been perfected, and are filling a long-felt want.

Other New Developments

Electric control has recently been applied to a milling machine for roughing out sheet-metal punches and dies. A templet is provided of the exact shape of the hole in the die, and the feed movements of the cutter are controlled from this templet by electricity.

An interesting process recently developed is chrome plating. While still in an experimental state, this promises to be useful in certain lines.

The welding of stellite has provided a successful method of adding a hard, heat-resisting surface to steel, and this is now being applied to the ends of plug gages, to parts of machinery subject to wear, and to mechanisms subject to both high temperatures and wear, such as the parts of automatic furnaces and hardening machines.

At least three automatic station chucking machines have been perfected in the past year. One of these is a vertical machine, fitted with automatic mechanical chucks, the other two being of the horizontal type, with air chucks. Development is shown in the design of grinding machines, including the wide-wheel machines used for straight-in feed.

Generally speaking, the year has been one of steady improvement in details rather than one of startling new inventions. There is a growing demand for machinery that conserves the strength and time of the operator, as well as for such apparatus as dust-suction systems, conveyors, automatic chucks, etc., which are quite as often installed to lighten the operator's work as to cut down costs. Whereas progress in any one direction has not been phenomenal or radical, there is hardly a type of machine on the market that has not been improved during the past year.

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MEETING OF AUTOMOTIVE ENGINEERS

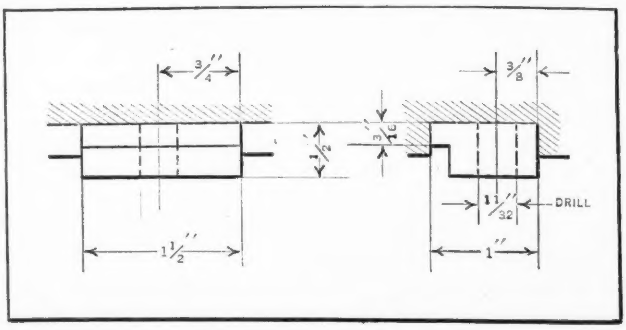
Thirty addresses on automotive engineering topics were made at the four-day national annual meeting of the Society of Automotive Engineers held in Detroit, January 25 to 28. Ten technical sessions were devoted to such subjects as employe training, production methods, body construction and painting, transmissions, chassis design, and detonation or engine knock. One complete session was devoted to the design of light cars.

At the production sessions the following papers were read: "Hardness and Machineability Tests of Gray Iron Castings," by E. J. Lowry of Hickman, Williams & Co.; "Chromium Plating," by W. N. Phillips of the General Motors Corporation; "The Application of X-rays in the Automotive Industry," by G. L. Clark of the Massachusetts Institute of Technology; and "Production Control," by M. A. Lee of the College of Engineering, Cornell University. The papers read at the meetings will be published in the journal of the Society of Automotive Engineers, 29 W. 39th St., New York City.

LUCAS TONGUE BLOCK FOR FIXTURES

The purpose of the tongue block shown in the accompanying illustration is to adapt jigs and fixtures to milling machine or planer tables having different sized T-slots. It has been in use in the factory of the Lucas Machine Tool Co., Cleveland, Ohio, for a number of years, and has been found very useful.

The groove in the under side of the jigs and fixtures has been standardized to 1 inch in width. The upper portion of the tongue block is accordingly made 1 inch wide, using standard size stock, 1 by 1/2 inch. One side only is machined, as shown. The width of the lower portion of the block is made to correspond to the width of the throat of the T-slot in the machine table. The 3/8-inch hole for retaining screws is drilled 3/8 inch from



Tongue Block for Adapting Jigs and Fixtures to Machine Tables having Different Sized Slots

the side of the block. This tongue block is of especial interest at this time, because of the work being done to standardize small tool and machine tool elements. Perhaps a standard tongue block designed along the lines of the one shown will also prove valuable in other factories.

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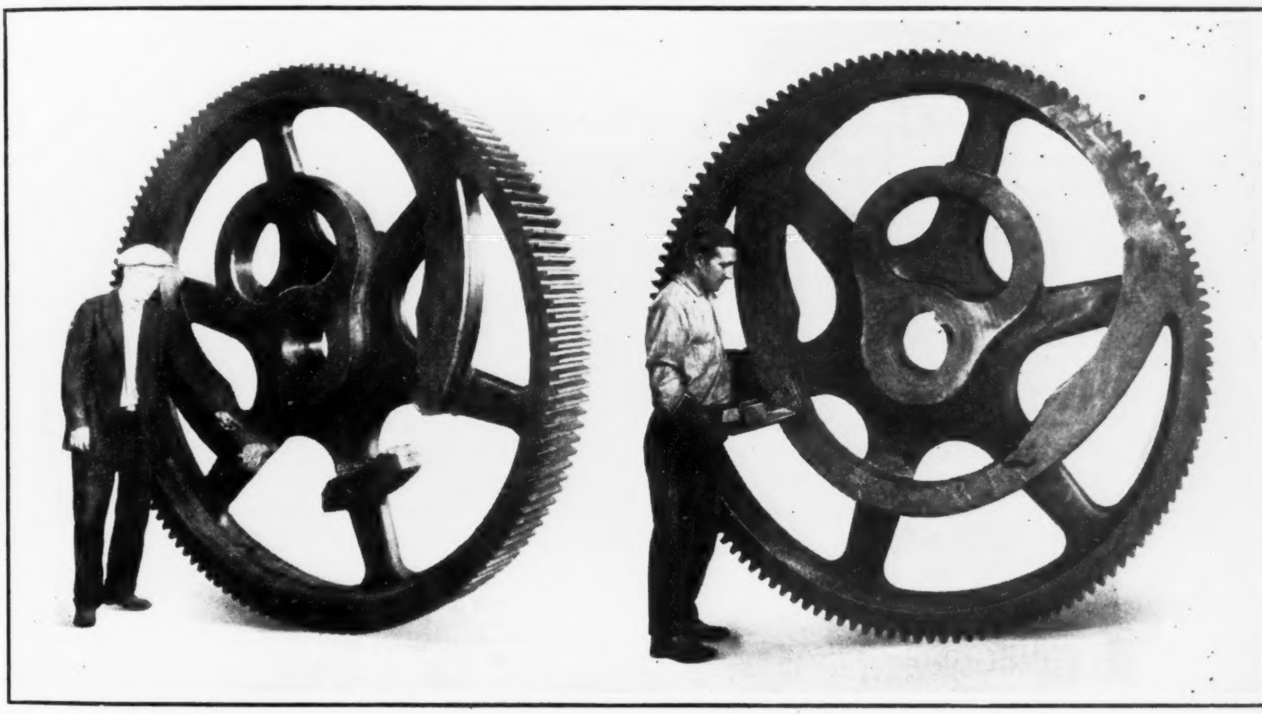
MEETING OF WELDING SOCIETY

The American Welding Society held a joint meeting with the Metropolitan Section of the American Society of Mechanical Engineers on January 4, at which a number of papers relating to welding practice and design for welding were presented. S. W. Miller, of the Union Carbide and Carbon Research Laboratories, Long Island City, N. Y., presented a paper on "Examination of the Ruptured Head of an Ethylene Tank." H. E. Rockefeller, of the Linde Air Products Co., New York City, read a paper on "Oxy-acetylene Welded Construction of a Large High-pressure Storage Tank," and T. W. Greene, of the same company, read a paper on "Stresses in Large Welded Tank Subjected to Repeated High Test Pressures." W. L. Warner, of the industrial engineering department, General Electric Co., presented a paper on "Replacing Castings by Welded Structural Shapes in Machine Design," (see page 421 of this number of MACHINERY) and A. B. Kinzel, of the Union Carbide and Carbon Research Laboratories, Long Island City, read a paper on "The Design of Dished and Flanged Pressure Vessel Heads." Most of these papers will be published in the February number of *Mechanical Engineering*, the journal of the A. S. M. E., 29 W. 39th St., New York City.

Replacing Castings with Welded Designs*

By W. L. WARNER, Industrial Engineering Department, General Electric Co., Schenectady, N. Y.

THE structure of cast iron is comparatively coarse crystalline, and the metal possesses considerable hardness, but lacks toughness. Cast iron is non-ductile at all temperatures, and cannot be deformed without being broken. It finds its widest field of application in machine construction. No other metal that can be cast in complex forms can be produced with such ease and at so low a cost. Ordinary cast iron has several competitors in this field, the principal ones being malleable castings, steel castings, and cast brass and bronze, but while all these materials have properties not possessed by cast iron, such as greater strength, toughness, or non-corrodibility, they are also more expensive. Therefore, in the past, when the conditions of service have been such that cast iron could meet them, it has no competition. The advent and development of fusion welding, however, has given a new aspect to this situation.



Figs. 1 and 2. A Broken Combination Gear and Cam Repaired by Electric Welding

Physical Properties of Cast Iron

Consider for a moment the physical properties of cast iron. These properties are dependent upon so many variable factors, such as foundry methods, design and size of casting, composition, and the form in which the various constituent parts exist in the iron, that it is very difficult to make a general statement concerning them. We may say, however, that the ultimate tensile strength varies from about 16,000 pounds per square inch for soft gray iron to approximately 35,000 pounds per square inch for hard gray iron. The yield points are found to vary from about 5000 pounds per square inch for soft iron to approximately 22,000 pounds per square inch for hard iron.

No constant ratio exists between stress and strain for any considerable load interval, and, therefore, we cannot rightfully say that cast iron has a modulus of elasticity. The percentage of elongation is small and seldom exceeds 3 or 4 per cent. The reduction of area is usually too small to be noted. The factor of safety ordinarily employed in the design of iron castings is about 7, and the safe working stress of cast iron in tension is generally considered to be about 3000 pounds per square inch.

The compressive strength of cast iron is also subject to wide variations. The factors that control compressive strength are exactly the same as those that control tensile strength. Under pure compression, the ultimate strength may vary from 50,000 pounds per square inch to approximately 150,000 pounds per square inch. For short blocks, the safe working compressive stress is usually assumed to be about 16,000 pounds per square inch. For other shapes, this value should be reduced 50 per cent or more, depending upon the ratio of the length to the radius of gyration of the cross-section.

Properties of Malleable Castings

Malleable cast iron is cast iron of special composition which has been made malleable by a process of annealing. The iron used must be a

*Abstract of a paper read before the Machine Shop Practice Division of the Metropolitan Section of the American Society of Mechanical Engineers in a joint meeting with the New York Section of the American Welding Society, January 4.

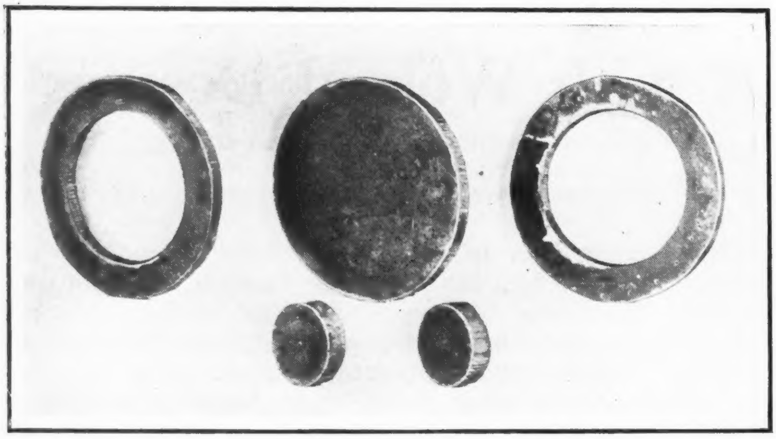


Fig. 3. Parts for Welded Steel Pinion Cut Out from Flat Rolled Steel Plate by an Automatic Gas Cutting Machine

white iron, with the carbon almost wholly in the combined form, so that the annealing operation will result in converting the combined carbon into free carbon in an amorphous condition, with no resemblance to free carbon in the crystalline form, as graphite. Under this condition, the amorphous carbon will exist as isolated particles in a continuous mesh of metal. In this way, the casting is made much tougher than white or gray cast iron, and its ductility and malleability are increased to such an extent that it may be bent or twisted to a considerable degree even when cold.

The average ultimate tensile strength of malleable cast iron usually varies between 40,000 and 50,000 pounds per square inch. The elongation is seldom less than 2 1/2 per cent and may amount to as much as 7 per cent. While no definite data concerning its shock resistance are available, malleable cast iron has long been considered to be especially suitable for use where often repeated light shocks are encountered. In this respect, it is sometimes considered superior to cast steel. Malleable iron is especially useful in the manufacture of that large class of articles whose form is too complicated for economical forging, but which must possess a strength and toughness not attainable in gray iron castings.

The Influence of Welding on Machine Construction

The development of improved welding methods during the last ten years has placed at the disposal of steel and iron workers a process of joining metals which is rapidly revolutionizing industrial production methods. Welding is truly a steel founding process applied locally on a small scale. It makes possible the joining of metals satisfactorily, with minimum time and labor for preparing and completing the job.

By substituting rolled material for cast material, industry is following somewhat along the lines of past experience. It is a common experience to find broken castings—machine parts broken in transit or service, or castings that have failed through some small defect. In fact, for several years, the world at large considered welding as a process to be used only for repair work, and the repair of broken machinery castings was thought of as the only great field of application. Even now some people regard the welding process as a repair method only and refuse to accept it for production work. One thing is certain, however, and that is that no one would take up welding on such a large scale as is being done at the present time, unless there were some economic advantages to be gained thereby.

Advantages of Welding

In the first place, the use of a rolled section instead of a cast section is desirable whenever possible, because of the reduction in the amount of metal required for the same strength and stiffness. The rolled section was originally a casting which has been reduced to its final shape by a process of mechanical working that has refined the grain

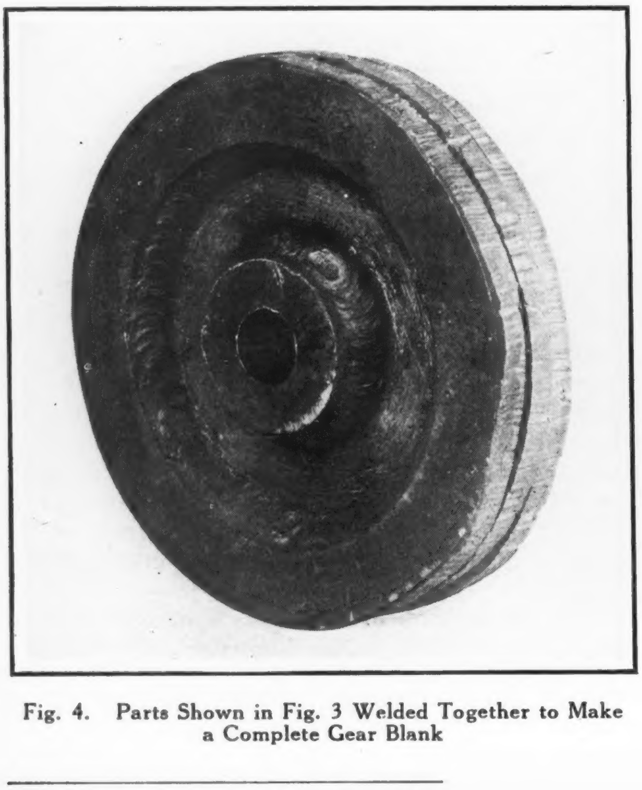


Fig. 4. Parts Shown in Fig. 3 Welded Together to Make a Complete Gear Blank

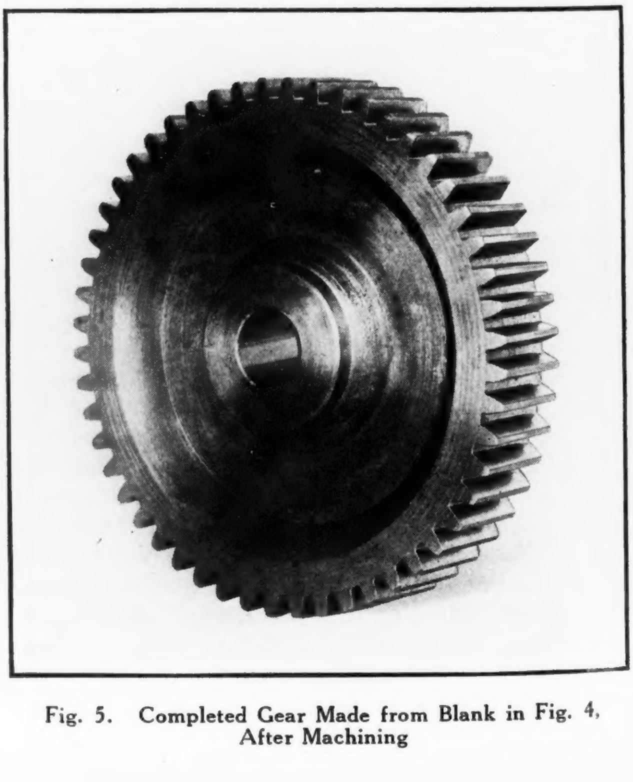


Fig. 5. Completed Gear Made from Blank in Fig. 4, After Machining

structure and improved its physical qualities. Also, pound for pound, the rolled section is cheaper, costing anywhere from two to four cents per pound, as against seven to nine cents for the casting.

There is less waste involved in the fabrication with rolled material than with castings, and the number of machining operations is less. It is possible to fabricate within very close limits—almost exactly to size—while a certain allowance must be provided for in castings due to shrinkage, roughness, and physical variations in the molding operation.

The elimination of the pattern shop and pattern storage is another feature that follows the fabrication of rolled material. This item reduces overhead—the great problem of the factory cost department.

It goes without saying that the use of welded rolled shapes makes this development more attractive to the designer and fabricator because of the flexibility of the process. If changes are necessary during construction, it is easy to cut out and fit in pieces to make the change, while with a casting, a new mold is usually required.

There is also the possible chance of using automatic welding machines for this work, and this procedure always reduces costs. The welding machine will perform continuously without tiring, while the manual welder requires a certain amount of relaxation and relief from holding the arc over long periods. Also the problem of labor turnover becomes less acute where the main dependence is placed on machines for performing routine jobs.

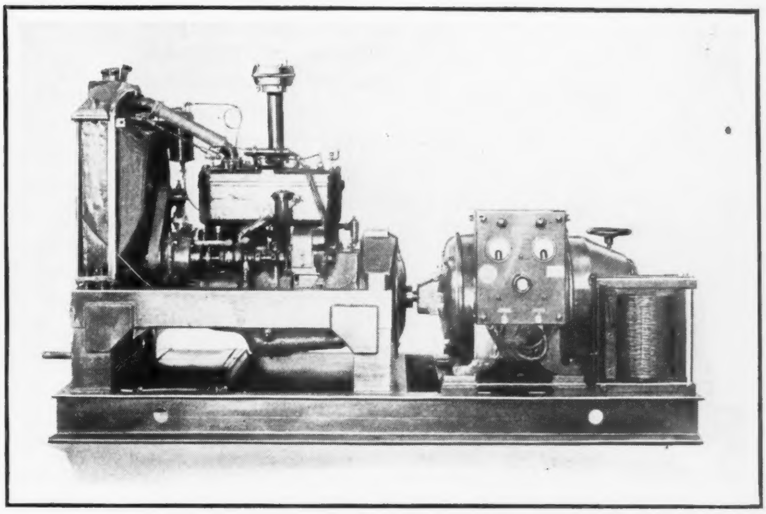
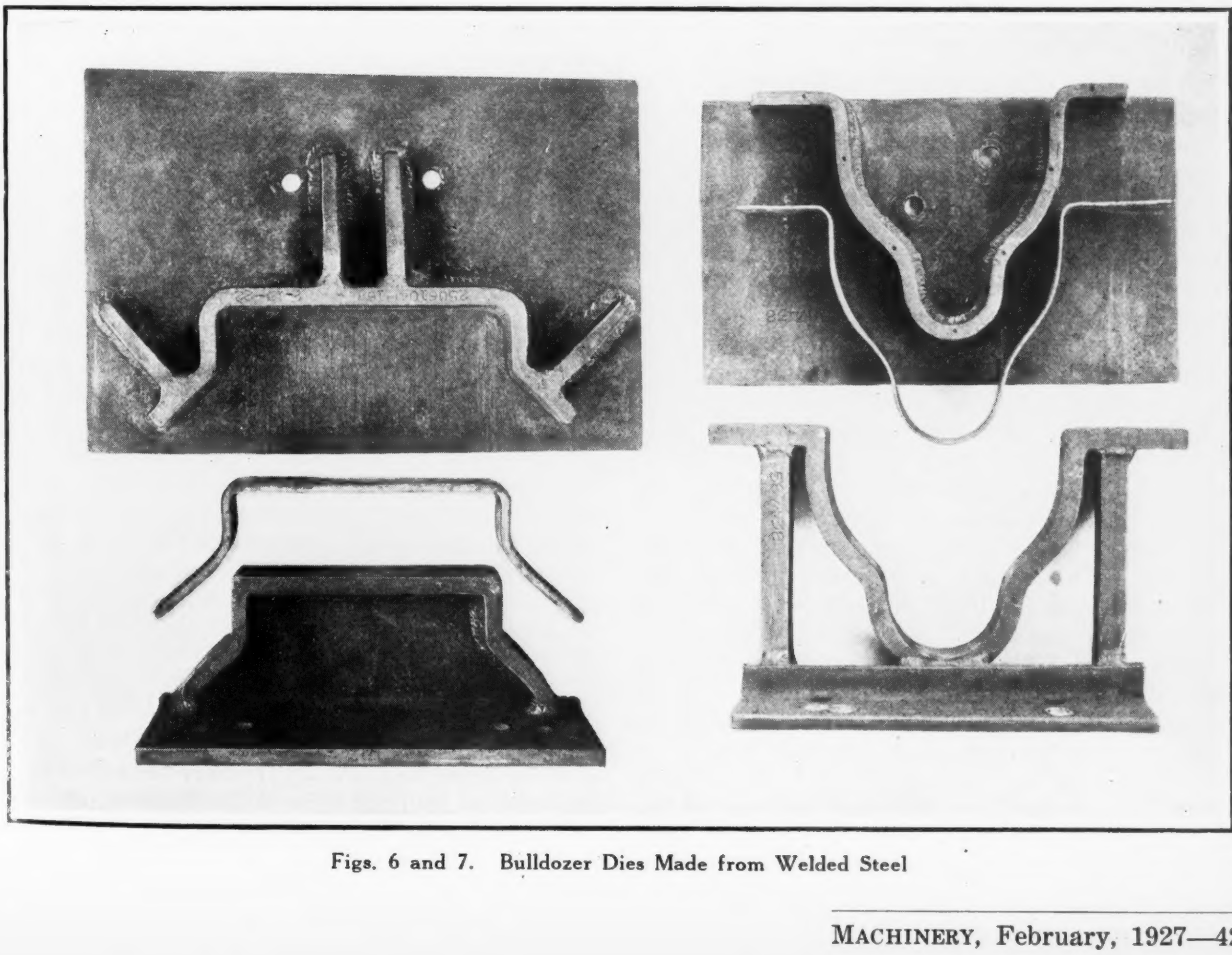


Fig. 8. Base for Arc Welding Set Welded from Structural Steel Shapes and Plates

It must not be supposed from the foregoing that the substitution of welded fabricated shapes for castings is taking place without the engineer being confronted by complicated problems. The problems of expansion and contraction, type and design of weld, size of plate, jigs and fixtures, amount of weld, and methods of assembly, necessitate a very careful study. These problems, however, have been successfully solved, which is another proof of the old axiom "Where there's a will, there's a way."

Examples of Welded Designs

An example of some of the simplest applications of welding to the repair of machinery parts is illustrated in Figs. 1 and 2, where the repair of a cast-iron gear and cam is shown. No preheating or annealing were necessary.



Figs. 6 and 7. Bulldozer Dies Made from Welded Steel

The use of automatic welding machines for performing routine welding operations is desirable whenever the nature of the product is such that the work of setting up does not consume more than approximately one-third of the total time required for the whole job. This condition is, however, relative only, and should not be considered as a hard and fast rule. Figs. 3, 4, and 5, inclusive, show a method of replacing gear castings by rolled steel plate. The parts are cut from flat rolled steel plate by an automatic gas cutting machine, and put together with an automatic welder.

Sometimes it is possible to build up forming dies for use in forging presses, by welding. When this is done, considerable—if not all—machine work may be eliminated. Figs. 6 and 7 show two welded bulldozer dies. These replace more expensive cast-steel and drop-forged dies.

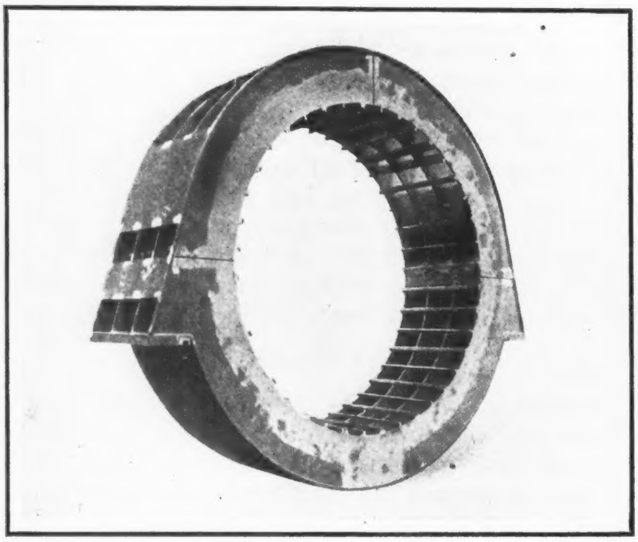


Fig. 9. Welded Steel Frame, 18 Feet in Diameter, for Synchronous Condenser

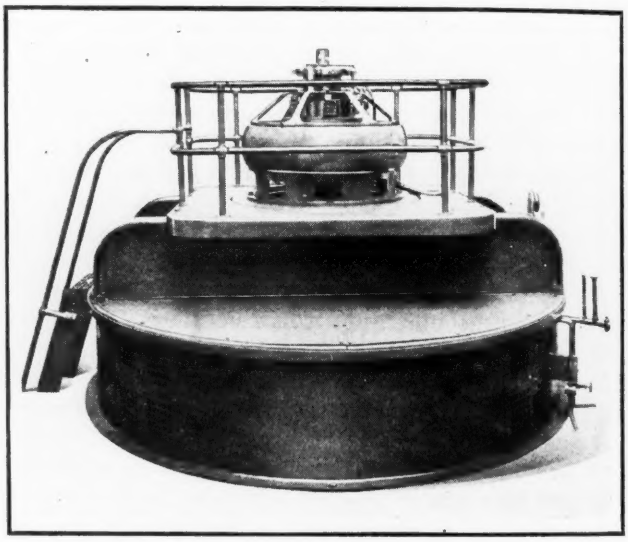


Fig. 10. Welded Steel Frame for Vertical Waterwheel-driven Generator

One of the earliest changes from castings to welded steel construction was on the bases for arc welding sets, as shown in Fig. 8. This type of construction is lighter and cheaper than the casting, and stands up better under the rough service to which these machines are subjected. Evidently, it is only a question of time before this type of construction will replace the majority of cast bases. Before this happens, however, methods of design, welding data, and manufacturing details must be very carefully worked out, so that no more labor will be required than with the cast construction.

One of the most interesting applications of welded structural steel parts in place of castings is the work that the General Electric Co. has been doing with the stator frames of electrical machines. Fig.9 shows a welded steel frame for a synchronous condenser. This frame is approximately 18 feet in diameter, and is built entirely of rolled-steel plates welded together. A completely assembled vertical waterwheel-driven generator with welded steel frame and exciter bracket is shown in Fig. 10.

From the illustrations, it is evident that welding is making possible some very startling changes in methods of machine construction of various kinds. The activity in the structural steel industry at the present time is further evidence of the awakening interest in the possibilities of the welding process.

WEAR-RESISTANT GAGE MATERIALS

At the meeting of the Gage Steel Committee recently held in New York, many interesting conclusions from tests carried out by the committee were brought out. The question of "file-hard" and "file-soft" gages was discussed, and it appeared to be the consensus of opinion that "hardness" is an indefinite term, and that at present there is no known relation between "hardness" and "resistance to wear." It appears to be fairly certain that "hardness" cannot be taken as a measure of resistance to wear, at least, without definite specifications as to the way "hardness" is to be measured and expressed, and as to the character of wear.

Results so far obtained indicate that file-hard chromium bearing steel is more resistant to wear than file-hard carbon steel under conditions of metal-to-metal wear. This is true when gaging both file-hard steel and an aluminum piston alloy. Stellite is somewhat more resistant to abrasive wear than chromium-plated carbon steel or chromium-bearing steel in file-hard or file-soft condition, and also slightly better than the two latter steels in file hard condition under metal-to-metal wear.

The difficulties and advantages of chromium plating of gages were discussed at some length. It was reported that one company had found that chromium-plated gages give from ten to twenty times the service of ordinary hardened steel. While, difficulty is sometimes experienced from peeling or flaking of the chromium plating, and from inequalities of thickness, chromium plating is not essentially more difficult than nickel or copper plating, and all serious difficulties will doubtless soon be overcome.

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OIL POWER WEEK FOR 1927

During the so-called "Oil Power Week" scheduled for April 18 to 23, 1927, more than fifty meetings will be held throughout the country, at which subjects relating to oil engine design and operation will be discussed.

What MACHINERY'S Readers Think

Contributions of General Interest are Solicited and Paid for

REMUNERATION FOR CONSULTING SERVICE

I have read the article "Remuneration for Consulting Engineering Service" in October MACHINERY with a great deal of interest. I have continually had the same experience as the author of that article, and have given considerable thought to a solution of the problem. The vast majority of manufacturers and other industrial men seem to take it for granted that the consulting engineer's time is theirs to use without paying for it. This must be corrected, and is a subject well worth taking up in the technical press.

I have not come to any definite solution, but am considering the following ideas. Generally, I arrange for the manufacturing of a considerable part of the projects that I develop, and in so doing receive my compensation in the way of commission from the manufacturer with whom I place the order; but I continually deal with people who obtain my ideas and assistance, without which they would be unable to go ahead, and then proceed to shop around to get the work done.

In one case I showed a manufacturer a method whereby he could save fifteen cents on each of a quantity of articles made. He then went ahead and placed the business with someone else, using the method I had proposed, because in that way he was able to save a fraction of a cent as compared with my quotation. He did not feel in the slightest indebted to me for saving him fifteen cents per piece. In the future I have in mind to charge in full for all services rendered, and then, if I place the business, I will refund part or all of the charges made.

All consulting engineers must try to educate the man who wants engineering service so that he will recognize that he must pay for such service. Consulting engineers must work together in this, because the best results can be obtained, either in the trades or the profession, by group methods. However, in starting something new, someone must be the pioneer, and, if he is successful, others follow. I am willing to be as nearly as possible the first one to try this new method. It must be done in justice to consulting engineers, but it is a pity that it should be necessary for us to educate men to see that there is just as much obligation to pay for engineering services as to pay for medical or legal services.

C. D.

The article in October MACHINERY, "Remuneration for Consulting Engineering Service," is very much to the point. My experiences have been much the same as those of the author of that article. I would like to cite an example.

A responsible concern had been advised that a large double-headed wood shaper would be adapted to do certain work in their plant. The machine required some modification to meet the requirements. I visited the plant, as well as the dealer who wanted to sell the machine, with a view to determining whether the machine was suitable. It developed from this investigation that it was not—that it was too heavy, that the spindles were out of proportion for the work, and that the dimensions of the table, feed rolls, and gearing were too great, and that the space required was unnecessarily large.

The result was that I submitted a report to the effect that this machine was an undesirable investment at any price, and that the expense of trying to modify it for this work would be greater than the cost of a suitable machine intended for the work. The report was put in writing. In all I spent fourteen hours of my time on this work. I sent with the report a bill for $25, which the manager of the concern refused to pay, saying that I had done nothing definite or of value. I replied that I had at least prevented him from purchasing a machine which would have been a white elephant on his hands and that, therefore, he was in at least that much through my services.

Had I been less conscientious I might have advised the purchase of the machine, and designed a device for adapting it to the work at hand, in which case I doubtless could have collected my fee without trouble.

In another case, a prominent attorney wanted my opinion on a special mechanism. I spent a whole day in investigation and the evening in preparing a written report. While my report was acted upon, the bill for my services has not yet been paid.

I think that consulting engineers are worthy of their hire, just as much as doctors and lawyers, and I think that approximately the same rates that are charged by doctors and lawyers are reasonable pay for the services of a competent engineer. If a doctor charges $5 for a simple consultation, a consulting engineer is entitled to charge the same; and if a lawyer charges $20 for writing a contract, a consulting engineer is entitled to the same compensation for presenting a report of equal length. The engineer's training requires just as much work and study as that of either of the other two professions mentioned.

JAMES MCINTOSH

THE VALUE OF DEFINITE PLANNING

If anyone were to ask the writer what is most frequently the trouble with industrial management in the thousands of enterprises throughout the country, he would say the lack of ability or willingness to plan sufficiently far ahead so as to be prepared for contingencies as they arise.

Most people, both in business and in their private life, avoid planning ahead if they can possibly help it. Planning requires not only imagination (because it involves a complete understanding of conditions that have not yet arisen) but also a

certain amount of stamina, will power, and character in sticking to the plans that have been laid down, even though to do so involves going through with a difficult job.

Most men, unfortunately, prefer to avoid making an analysis of future conditions. They rather meet each issue as it arises, swim along with the current, and make no effort to forestall troubles before they are actually upon them. This also means that they avoid laying down for themselves rules and regulations for controlling their actions, thereby frequently eliminating the very difficulties that they now have to meet at regular intervals.

If the work to be done in a shop or factory and the methods to be followed in the conduct of a business were thoroughly planned far ahead, the mechanism would run very much more smoothly than it now does. There are some firms that plan in considerable detail what the designing department, the shop, and the sales department is going to do for twelve months ahead. These firms have found that planning pays, and that it is possible, by careful planning, to estimate future conditions with an accuracy of from 5 to 10 per cent of actual performance, which is quite a remarkable thing in the conduct of a business.

It would be interesting to hear from those who have made it a practice to definitely plan for their business a year ahead and to learn how they go about it and what results they have obtained.

J. S. G.

ACCURACY OF STATISTICS

Accurate statistics are of great value in the industries, and those compiled by the Bureau of Census furnish a reliable guide in many fields of activity. The accuracy of these statistics is sometimes questioned, and at times, doubtless there are errors, but when errors occur, it is not generally the fault of the Bureau of Census, as the reports compiled are checked and rechecked with extreme care. Generally, these errors are made in the data furnished by manufacturers who have not been as careful as they should have been in filling out the blanks furnished by the bureau. Sometimes this work is given to an inexperienced clerk, and hence errors creep in.

The Division of Manufactures of the Census Bureau collects statistics for about 360 separate industries, a number of which are further subdivided into groups, so that statistics are compiled for over 600 groups. The machine tool industry is just one of these groups. It is evident that the Bureau of Census cannot employ an expert for each of these 600 or more industries, whose judgment would enable him to detect an error in a report, as for instance, if he noticed that a manufacturer with a comparatively small plant reported an unusually large production, or vice versa. However, the bureau has made its questionnaire so simple and direct that there should be no difficulty in answering it.

Few people realize the extent of the census work on manufacturing alone. Two hundred fifty people are employed the entire year in compiling, checking, and rechecking the statistical data to be published. It is very unfortunate, after all this care has been taken and money spent, if the information should prove inaccurate because incorrect figures have been furnished to the bureau. The Census Bureau furnishes the only complete record of industrial production and conditions that is available in the United States. It is the only means available for comparing past and present production. In every case, therefore, great care should be taken to furnish accurate and reliable reports to the Bureau of Census for its statistical work.

STATISTICIAN

QUALIFICATIONS OF ENGINEERS

In a special report issued some time ago by the National Industrial Conference Board, it was pointed out that it is more important that a greater proportion of the graduates of engineering schools be young men of the highest qualifications than that the total number of graduates be increased. It was suggested that the admission to engineering schools should be based on selected tests for general fitness for the engineering profession, intelligence, and character, as well as specific knowledge in given subjects.

The writer wishes to emphasize this point and to start a discussion that will bring forth the opinions both of men in the industrial field and of educators in engineering institutions. Do not our universities in general and our engineering schools in particular put entirely too much stress on examinations that indicate merely knowledge of mathematics, physics, chemistry, etc., and is there not less attention paid to the general qualifications needed for success in the engineering profession—common sense, judgment, character, ability to get along with men, proper mental attitude, discipline, self-control and many other things that are just as important in engineering practice as mere theoretical knowledge?

Could not the engineering schools aid in developing these qualifications in students and could they not even make the possession of a certain degree of these qualifications a necessary condition for graduation? Should a man be considered qualified to do engineering work merely because he possesses a certain amount of book knowledge, when he may be unfit in almost every other respect to deal with the problems that a man trained and educated as he has been should be able to handle?

Do we not pay entirely too much attention to the results of examinations and test questions in educating our young people and entirely too little attention to other qualifications that really are fully as important in deciding success or failure in a given career? Constructive suggestions on these points would probably be of value in forming the opinions of educators and making for a broader view of engineering qualifications. In any event, an exchange of opinions on a subject of this kind would be well worth while.

ENGINEER

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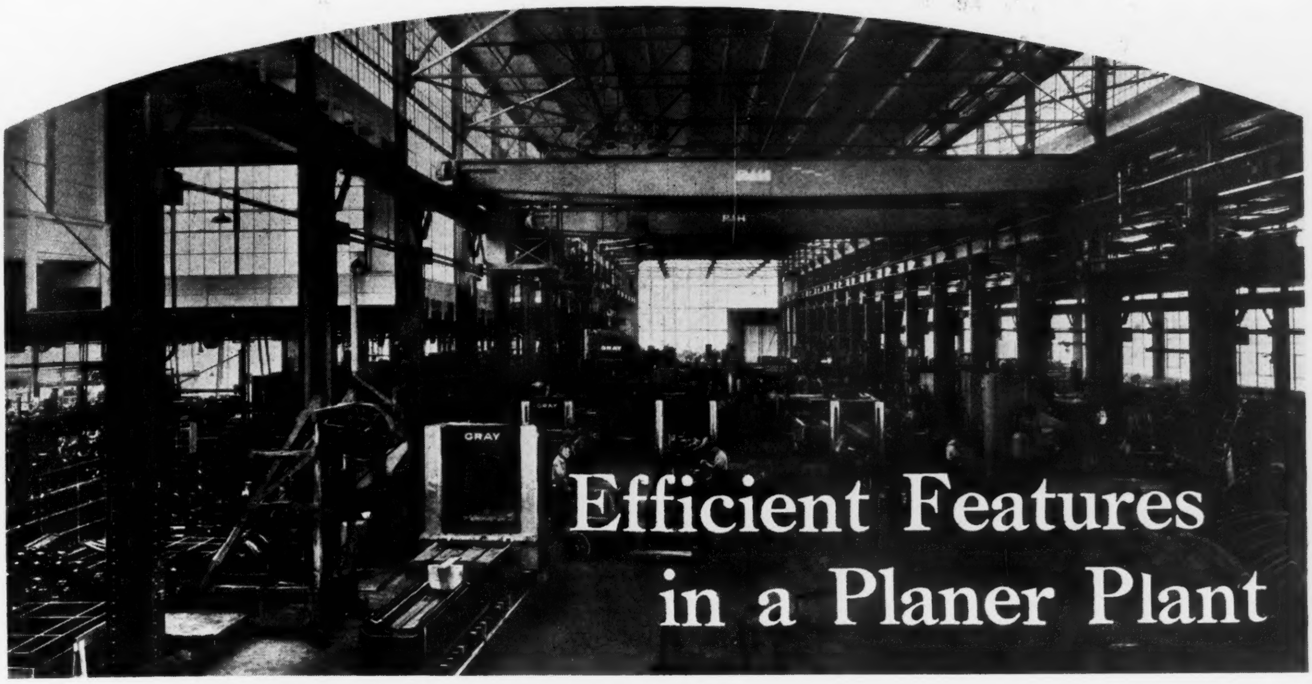
Metal-working machinery exports from the United States to Chile, rose from $213,500 in 1924 to $485,160 in 1925. Construction and conveying machinery has been in great demand for several years, and the demand is rapidly increasing.



Efficient Features in a Planer Plant

Points of Interest in the Plant Recently Built by the G. A. Gray Co.

WHEN a concern that has been in existence for many years plans the erection of a new shop, past experiences usually suggest many features that will promote efficient operation. During more than forty years of planer building, the G. A. Gray Co., Cincinnati, Ohio, has accumulated a knowledge which has been liberally drawn upon in laying out the new shop of that concern. Features have been incorporated to facilitate the handling of raw materials, finished planers, and scrap; to provide convenience in operating the machines; and, last but not least, to safeguard the health of the employes. Some of these features will be described.

The shop comprises a floor space of approximately 76,000 square feet. The main bay, which is shown in the heading illustration, is 60 feet wide by 420 feet long, and is served by two cranes, of 25 tons capacity each. When the hooks of these cranes are in their highest position, the distance from the hooks to the shop floor is 25 feet.

Castings are delivered at the western or far end of this bay, as viewed in the heading illustration, from the foundry of the company. Beds go first to the planers, then to a horizontal floor boring mill, then to a radial drilling machine, and finally to the erecting floor. They never leave the central bay, and move continually eastward. Tables move in the same direction.

Rails and top braces are placed on the planers in the main aisle, and taken off by the crane in the north aisle, which is 50 feet wide and parallel to the main aisle. In the north aisle, these parts are drilled and sub-assemblies added, after which they move eastward to the erecting and shipping floor. Small parts are machined in bays running to the left at right angles to the main bay. Craneways in these side bays extend out under the cranes in the main bay. The roof of the shop is of the "monitor" construction, with the roof of the main bay as the highest point.

How Fatigue is Reduced in Scraping-in and Snagging Operations

A mechanism that greatly reduces the fatigue of workmen in such operations as scraping saddles to rails is illustrated in Fig. 1. Saddle *A* is reciprocated on rail *B* by bar *C*. One end of this bar is fastened to a plug which seats in a hole in the center of the saddle. Rack teeth are machined on the under side of the opposite end of the bar. Air drill *D* drives a pinion which meshes with these rack teeth, and by properly regulating the air admitted into the cylinders of the drill, bar *C* can be reciprocated back and forth to scrape-in the saddle with the rail.

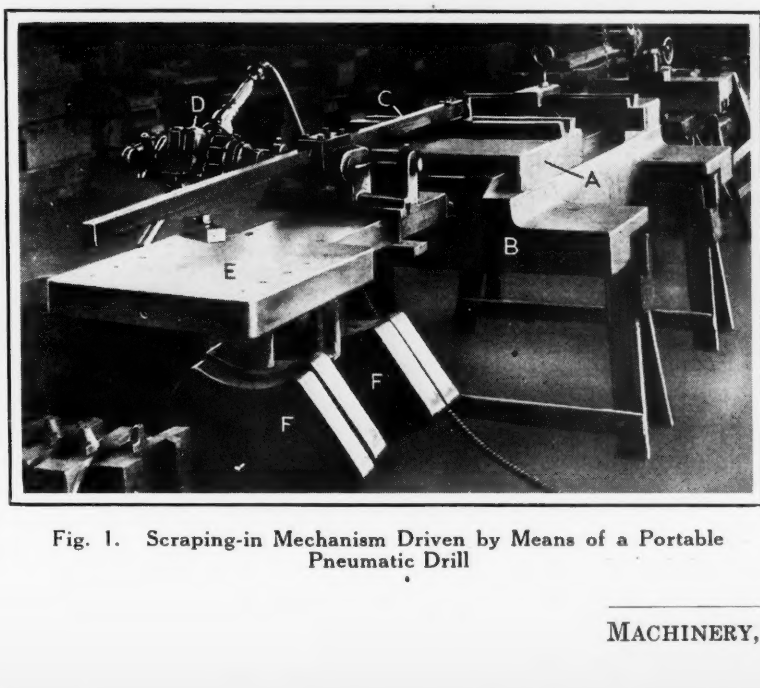


Fig. 1. Scraping-in Mechanism Driven by Means of a Portable Pneumatic Drill

Plate *E*, on which the mechanism is mounted, is supported by means of a screw jack, and so the equipment can be raised or lowered to suit the job. Counterweights *F* enable the mechanism to be used in

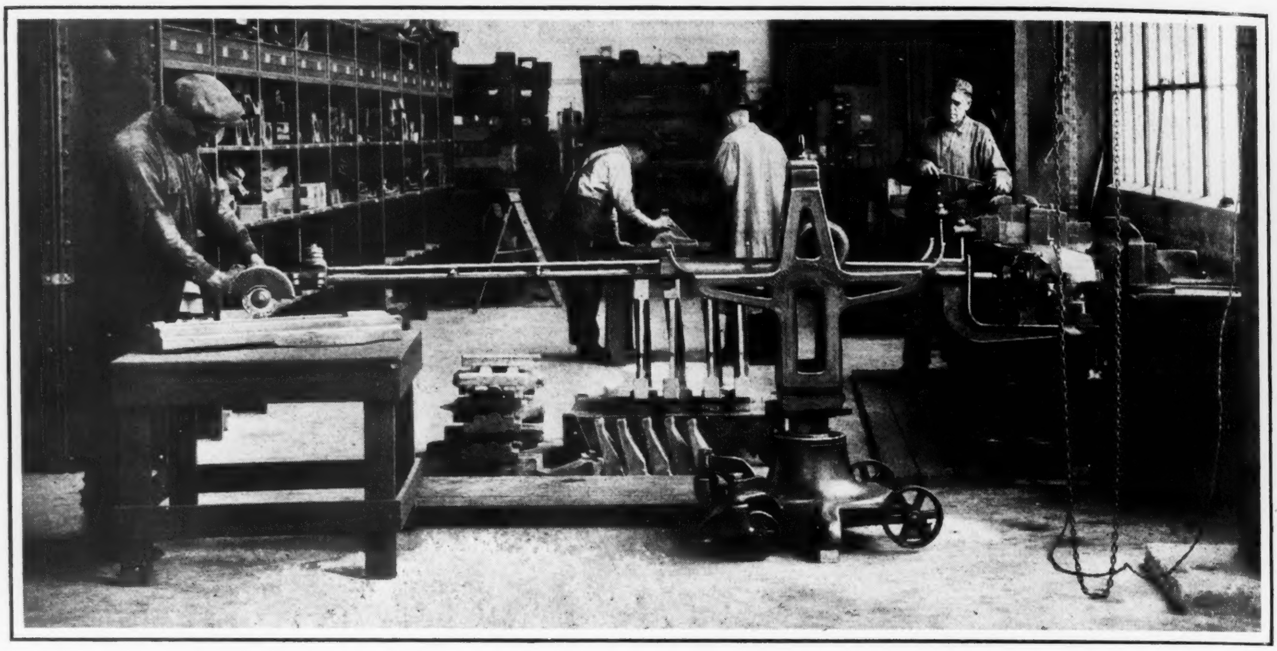


Fig. 2. Portable Grinding Equipment Employed in Snagging Castings

a tilted position. For scraping-in a side-head saddle to the housings, the mechanism is mounted directly on the housings.

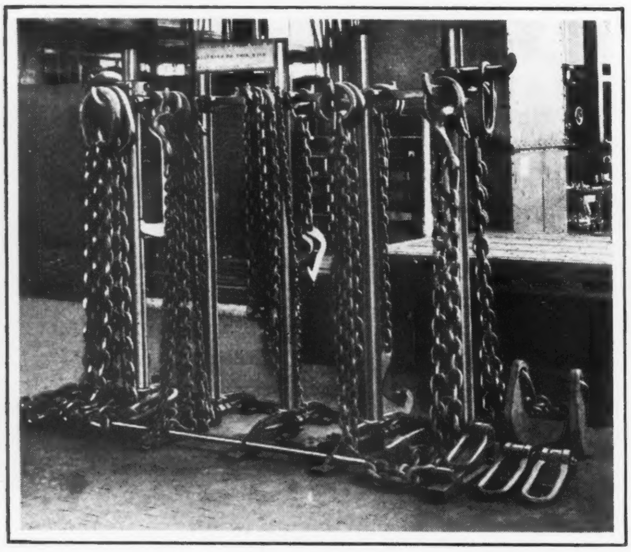


Fig. 3. Rack for Holding Crane Chains while not in Use

Portable outfits of the type shown in Fig. 2 are provided for rough-grinding operations on castings. The grinding wheel head is mounted on one end of a long bar, and driven by a motor fastened to the opposite end. To enable the grinding wheel to be moved back and forth over a casting surface, the bar is supported by a carriage equipped with gears which run on racks on the main housing. The gears serve as fulcrums in lifting the grinding wheel up and down, and the housing swivels to permit moving the grinding wheel around a complete circle in a horizontal plane.

Saving Time in Operating Machines

The operation of several planers in this shop has been expedited by placing controls on a tool-stand adjacent to the machine, as illustrated in Fig. 5. On the front of this tool-stand there is a switch *A*, with buttons which are depressed to start and stop the machine, wires being run through the floor to the reversing motor. In addition to this switch, there is a control on each end of the stand, such as shown at *B*, one of these controls being employed for regulating the speed of the cutting stroke, and the other for changing the speed of the return stroke.

All planers built in this plant are subjected to cutting tests before they are shipped. Reversing motors are employed for driving the machines in such tests, and these motors are mounted on skids, together with controllers, as shown in Fig. 6. When a planer is ready for the tests, a unit of this type is placed next to the machine, the motor adjusted to the proper height by turning the handwheels, and the motor shaft coupled direct to the drive shaft of the machine. Should the planer be arranged for a belt drive, the coupling on the motor shaft should be replaced by a pulley. Electric current for actuating the motor may be obtained from power outlets provided on all columns adjacent to the erecting floor.

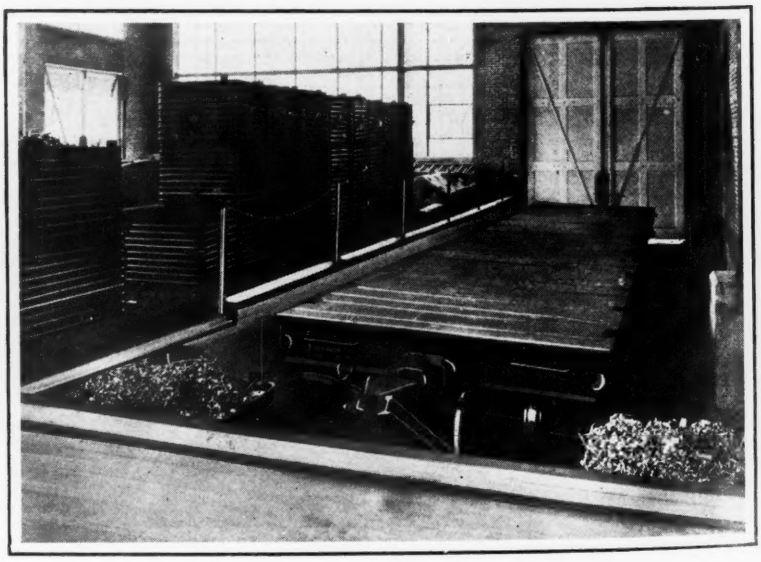


Fig. 4. One of the Railway-car Pits and Method of Storing Chips

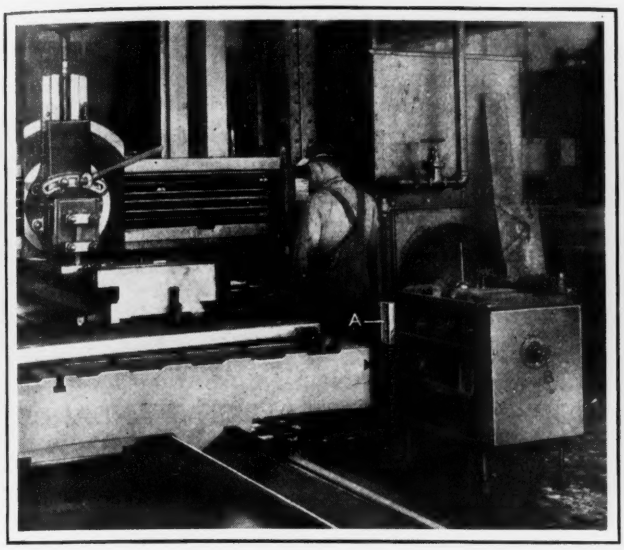


Fig. 5. Planer Equipped with Convenient Tool-stand on which Several Controls are Mounted

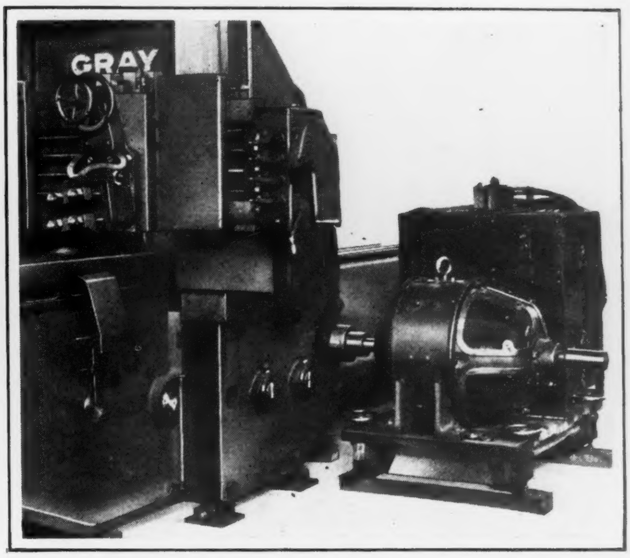


Fig. 6. Reversing Motor and Controller Mounted on a Skid, Ready to be Connected to Planers for Testing

In some shops, a great deal of time is lost, when transporting parts to and from machines by means of cranes, by having to hunt for chains and hooks. To obviate this, the rack illustrated in Fig. 3 has been placed midway along the main bay. All crane chains and hooks not in use must be hung on or laid adjacent to this rack, so that they can be readily found when needed.

How Chips are Disposed of

The matter of handling chips was given careful attention in planning this shop, and a method was finally adopted that requires minimum labor and, in addition, permits the chips to be conveniently stored wherever space is available. Strong metal crane boxes of the type shown in Fig. 4 are used for storing the chips until there is a sufficient quantity on hand to fill a railway car. The boxes are 48 inches long, 30 inches wide, and 30 inches deep. They have lugs on them that facilitate stacking them on each other, and are provided with trunnions at each end and a handle on one side so that they can be readily dumped when suspended from a crane. Two boxes are generally placed, as shown in the illustration, in a pit provided for railway cars, and into these boxes the chips are dumped as they are trucked from machines. When the boxes become full, they are stacked along the railway pit and replaced by empty boxes.

Construction of the Railway-car Pits

Railway cars on which raw materials are received or chips are to be shipped, are switched into

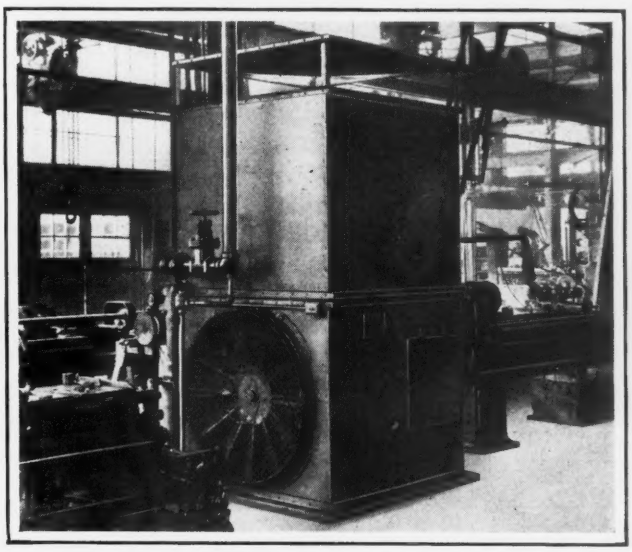


Fig. 8. One of the Blowers Used for Heating the Shop

the pit seen in Fig. 4, while finished planers and parts are shipped from cars switched into two pits at the opposite end of the shop. One of these pits may be seen in Fig. 7. All three pits are deep enough to bring the floors of the cars level with the floor of the shop, and this feature facilitates driving trucks on and off the cars. The pit shown in Fig. 7 runs at a sufficient angle relative to the main bay to enable both cranes to be used in loading machines on a car. Many parts are also received and shipped on motor trucks, and it was found desirable to have these trucks back into the same pits as those into which the railway cars are shifted. To make it possible to do this, the floor of each pit is filled with "Tarvia" to a level even with the top of the rails.

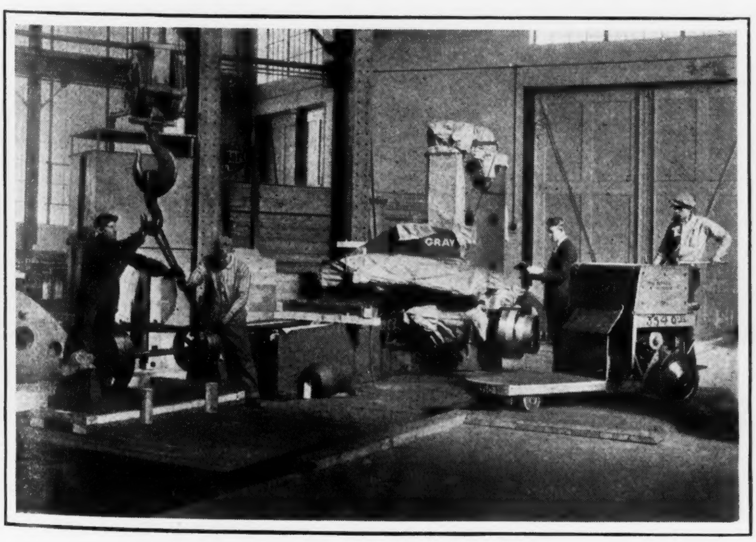


Fig. 7. How Planers are Loaded on Railway Cars Ready for Shipment

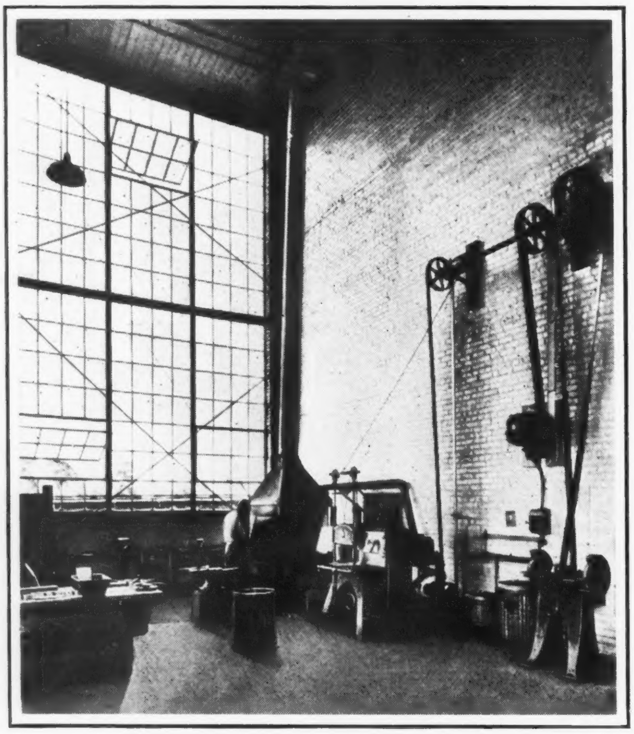


Fig. 9. A Blacksmith Shop that is Bright and Cheerful

Ideal Working Conditions

The monitor roof construction and the glass-paned walls on all sides of the shop provide natural daylight and conserve the eyesight of the men. The concrete floor of the entire shop is covered with wood blocks, with the exception of the erecting floor on which the planers must be leveled, and the grinding department floor, where water is likely to collect. Wood blocks could be provided on these floors at any time, level with the remainder of the shop floor. The wood blocks do not tire the feet of the men so much as a hard flooring, and are warm in winter.

Heating of the shop is accomplished by means of seven "Sirocco" blowers manufactured by the American Blower Co. These blowers have either one or two large fans near the base, as may be seen in Fig. 8, which draw air from the floor of the shop. The air is forced upward through a low-pressure steam chamber, and is exhausted horizontally several feet higher than the heads of the men. An enclosed motor drives the fans of each equipment. Drafts are not created by this equipment, and an additional advantage is the elimination of pipes on which dust and dirt would collect.

In many shops, the section assigned to the blacksmiths and heat-treaters is a gloomy place, but in this plant the blacksmith shop is about 35 feet high, and has windows running the full height of one side, as illustrated in Fig. 9. This illustration shows about one-half the length and one-half the width of the department. The windows are on the north side, and the other three walls are painted white. One-half of the floor is covered with cinders, while the remainder is made of concrete.

In the locker room, all lockers are painted a light gray, and this room is walled in merely by the lockers themselves, so that light comes from above and makes the room as bright as the remainder of the shop. Large wash troughs are furnished in this room instead of individual washstands, and hot and cold spigots are provided all along the trough.

The combined tool-crib and small-parts storage is also bright and well ventilated, as may be seen from Fig. 10. On two sides, the crib is partitioned off from the shop by storage racks, and on the other two sides, there is only a waist-high railing.

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WORK OF THE BUREAU OF STANDARDS

American industry is more and more turning to applied science as an aid in solving its many and intricate technical problems. This is made evident by the annual report of the director of the Bureau of Standards for the past fiscal year. From this report, it appears that the bureau maintains contact with industry through approximately eighty advisory committees and a large number of research associates who are sent by industrial groups to work on problems of interest to their respective industries. During the past fiscal year there were sixty-two of these associates at the bureau, representing thirty-six separate industries.

Nearly 180,000 tests, for which a fee of $675,000 was paid, were made by the bureau during the past year. These tests covered almost every field of industry. The simplified practice work was carried on with great activity, and forty-five simplified practice recommendations have so far been accepted by the industries, resulting in great savings in the production of articles in common use.

Among the many new developments worked out at the Bureau of Standards may be mentioned a blue glass for protecting the eyes of furnace workers. This glass provides good contrast between the appearance of the furnace walls and the melt, and yet cuts out the dangerous ultraviolet radiation.

In concluding his report, Dr. George K. Burgess, director of the bureau, points out the important needs of the bureau for the current year. There are many improvements, authority for which has been granted by the last session of Congress, but the appropriation for which must be made during the current fiscal year.

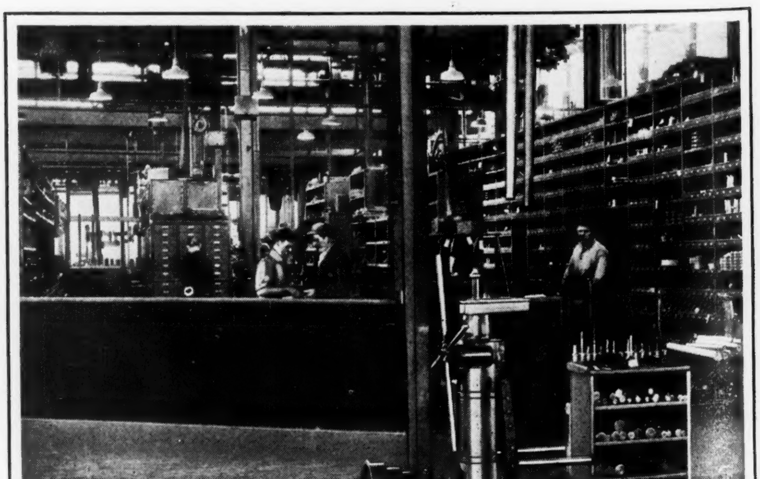


Fig. 10. General View of the Tool-crib and Small-parts Storage

Points on Making Jigs and Fixtures

By C. C. HERMANN

IN a recent article, the writer discussed various points that require careful consideration in developing or designing jigs. The present article deals with factors involved in the actual construction of the jigs. Obviously, the planning of the machine work requires a knowledge of the limits obtainable with the usual tool-room methods. The degree of accuracy required should always be determined by the toolmaker before work on a jig is commenced. Care may then be taken to employ methods that will give the required accuracy at the minimum cost.

Warpage of Work

Distortion or warpage of the work after machining is a factor in jig making which is often given insufficient thought. The writer has noted instances in which work was started on rough castings the day after they were received from the foundry. In some cases, high-priced toolmakers were allowed to spend hours in locating holes by the button method on new or green castings which were practically certain to warp after machining. The work usually leaves the toolmaker's hands before the relieving of the stresses takes place, and the distortion that occurs later necessitates scrapping many pieces. Often a casting with one side nicely planed lies around the tool-room for several weeks before the opposite side is machined. When the work is again taken up and the surface tested, it will be found to be warped.

Recently the writer came across three nicely finished slabs of gray iron, approximately 36 inches long in which there were several bored and reamed holes. On making inquiries regarding these pieces, the foreman of the tool-room remarked, with rather a long face, that the castings had shrunk after they were laid out and the three jigs had been rejected one after the other. The fourth one had miraculously remained accurate. Green castings are a source of trouble in the tool-room, yet few people seem to realize this fact. The production department often wants the tools at once. Thus, the tool-room, not having the castings in stock, finds it necessary to anneal the green castings and do as well as possible with the unseasoned pieces.

From the time the green casting is received until the completed jig is turned over to the production department, the requirements of the work for which it is designed must be kept in mind. It is necessary to know the accuracy required, which, of course, should be indicated on the blueprints. Cooperation between the tool-room and the drafting department is essential, in order to obtain dies and jigs of the required accuracy at a reasonable cost.

Preventing Distortion

Assuming that a green casting is to be machined, the first step is annealing. This process serves to relieve the internal strains. Even when this is done, however, the casting has a slight tendency to warp or become distorted when machined. The next step is to plane the surfaces or finish them in the manner decided upon. It is advisable to plane opposite surfaces in sequence. If one surface is planed and the scale allowed to remain on the other side, the casting will become warped. When the scale is removed from one side, the internal stress near the surface is removed, and consequently, the stress on the opposite side causes the work to change its shape.

Laying Out and Drilling Holes

There are numerous pieces that cannot be machined on the main surfaces, the finishing being confined to the supporting members or projections used for locating the jig on the production machine. In such cases, the holes should be drilled, but the boring left until the last operation. A plate having holes in a line, which are bored one after the other, will usually show a variation in the spacing of the holes. This is due to the relieving of the stresses by the drilling operations. By drilling all the holes first, and then loosening the clamps that hold the work on the machine, the internal stresses are relieved and the boring operations can then be performed with accurate results.

Following the planing of a piece, the holes must be laid out. It is then necessary to determine what system of measurement should be employed. Assuming that the designing department has specified the required dimensions and the limit of accuracy of each, the tool department must select a system of measurement that will produce the desired results. With the standard graduated scale, a limit of $\pm$ 0.002 inch may be maintained.

A toolmaker has informed the writer that he produced a piece of work having a number of drill bushings placed in a row with a total over-all dimension of 31 inches, which was kept within a limit of accuracy of $\pm$ 0.001 inch by carefully laying out the work with two 24-inch graduated scales. The scales were placed end to end, and the position of the holes laid off directly. The writer does not question the accuracy of this statement, but believes that such results are obtained more or less by accident, and it is not advisable to count on duplicating such work.

Limits of Accuracy

A limit of accuracy of $\pm$ 0.0005 inch may be obtained with a vernier caliper. This gives a total variation of 0.001 inch, and is considered the commercial limit of accuracy with this tool, although there are cases in which much closer limits have been maintained. It is not so much a case of what we can possibly do in the matter of accuracy, as it is a matter of safe or sure procedure. Many toolmakers make the grave mistake of attempting

to do something that they can brag about. The workman who is required to produce work within a total tolerance of 0.0002 inch, and is given a vernier caliper to work with, is not discredited in the least, in the writer's estimation, if he fails to meet the requirements. For such limits, the logical measuring device is the vernier micrometer.

In many tool-rooms, the vernier micrometer is considered the last word in accuracy. This is not strange, since bench measuring machines are expensive and the average workman is not versed in their operation. The limit of accuracy of the bench measuring machine is $\pm$ 0.00002 inch, giving a total variation of 0.00004 inch. This is looked upon as the commercial limit of accuracy. Needless to say, such accuracy is only obtainable by the finest polishing of the surface on metals of very fine grain texture.

Causes of Inaccuracy

The accuracy of the work depends largely on the condition of the machine tool, as well as on the measuring instruments employed. For example, the limit of accuracy obtainable on the ordinary drill press, with respect to the spacing of holes, is considered to be $\pm$ 0.003 inch, and the working limit is generally taken as $\pm$ 0.005 inch. This limit is not determined entirely by the condition of the machine, but rather by the non-uniform structure of the metal being drilled. A hard spot in the metal will crowd the drill to one side, producing a hole that may be off center several thousandths of an inch. A lower limit of variation is generally obtainable when a small drill, say, about a No. 50, is used first, following this with a larger drill, and finally finishing the hole by reaming.

The accumulated error resulting from the drill press method of producing a jig may be great enough to necessitate scrapping the work. The first error may occur in the laying out operation. With a steel gage, this error might be as large as 0.002 inch. The drill may run off center another 0.005 inch, due to hard spots in the material, and the final operation of reaming may cause another error of 0.003 inch, making a total of 0.01 inch, should all these errors run one way. Obviously, the production of a very accurate jig or piece of work by such methods may be considered to be accidental.

A much higher degree of accuracy can be obtained by using the button method of laying out, and employing a lathe or milling machine to produce the holes. The use of the button method requires a fine finish on the work comparable to that of a polished surface, and this extra work is avoided by most toolmakers when possible.

Steel Rule and Lathe Method

Assuming that a variation of 0.002 inch in laying out the work is satisfactory, provided that we eliminate any further inaccuracies, we can use the common steel rule in laying out or locating the holes, and then drill and bore the holes on the lathe. When laying out the hole centers, a very small prick-punch must be used. After rechecking the lay-out, a circle is scribed around each prick-punch mark, using a radius slightly larger than the radius of the hole to be drilled. After the work is laid out in this manner, it is secured to the faceplate of the lathe.

It is preferable to check the trueness of the faceplate with an indicator before clamping the work in place. All looseness in the spindle bearing should be taken up, and any bumpy action of the driving belt on the pulley, caused by belt dressing or faulty lacing, should be eliminated. The work should also be accurately counterbalanced to avoid the unbalancing effect on the lathe faceplate. When this is accomplished, the scribed circle of the hole to be drilled is indicated in order to make sure that the work is properly lined up with the boring tool. The hole can then be bored through the work. The hole is finished accurately to size with a second boring tool. Holes located and bored in this manner will be accurately positioned, frequently within limits as high as $\pm$ 0.0015 inch, where the laying out is done with the vernier caliper or a micrometer. A closer limit of accuracy than this requires the use of buttons.

Correct Methods Save Time

The writer has yet to see a piece of work in which the positions of the holes were laid out or transferred from one plane to another with a limit of accuracy of less than $\pm$ 0.002 inch, except by the plate method. The transfer of dimensions from one plane to another causes trouble, whereas if time is taken to produce a properly buttoned layout plate, in the end both time and materials will be saved.

Some toolmakers make the mistake of trying to work around corners and over ledges, when they know that such methods generally give unsatisfactory results. The temptation to employ such methods may often be eliminated by simple changes in the design. The writer strongly advocates sending the designer into the tool-room whenever possible, so that he may become thoroughly acquainted with its limitations. It is not necessary for him to become an expert toolmaker, but he should know what can and what cannot be done satisfactorily with the equipment and methods employed. The draftsman or designer who has actual toolmaking experience is of greatly increased worth.

* * *

PLASTIC WOOD—A NEW MATERIAL

A new material known as "Plastic Wood" has been introduced by the Addison-Leslie Co., of Canton, Mass. This appears to be a very interesting material which, while transported and sold in cans, and being in a soft plastic state, so that it can be molded with the fingers and pushed into a hole or crack, shortly hardens, so that it can be carved, planed, sandpapered, or turned in a lathe, the same as ordinary wood. It is said that it will adhere to metal, tile, cloth, and glass as well as to wooden surfaces, and that nails and screws can be driven into it without splitting it. It takes paints, stains, and varnishes the same as wood—in fact, it differs from wood only in that it has no grain. It can also be used in many places on machinery, for filling cracks or holes, where appearance, but not strength are of importance. For example, holes drilled by mistake can be filled and painted over in a machine base.

RADIUS-LINK MILLING FIXTURE

By HOWARD ROWLAND

Analyses of operations in shops will often show that if fixtures were built to facilitate some of the operations, the money expended would be more than justified by the savings effected. The accompanying illustrations show a milling fixture devised in a progressive railroad shop for milling the curved slot in locomotive radius links. Through the use of this fixture and a milling machine, instead of the two different types of machines previously required, the time of machining the slot, ready for grinding, was reduced from 8 to 1 1/2 hours.

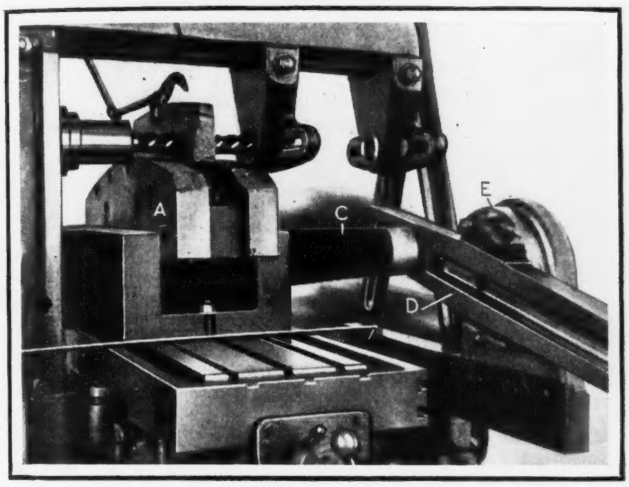


Fig. 1. Fixture Used in Milling the Curved Slot in Locomotive Radius Links

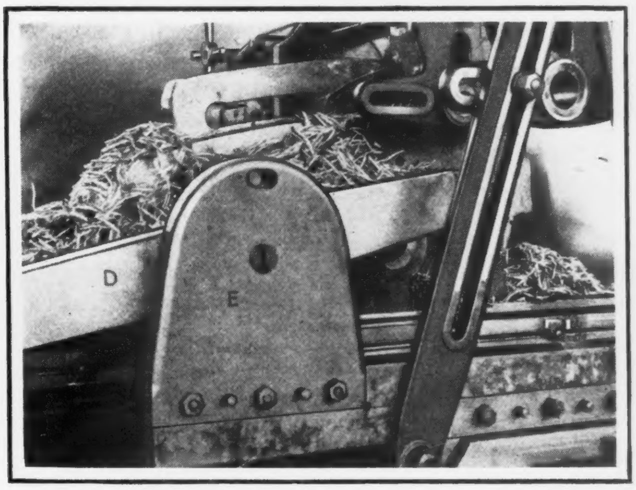


Fig. 2. Completion of the Slot Milling Operation on a Locomotive Radius Link

Before the link is brought to the milling machine, a hole large enough in diameter to receive the cutter is drilled in one end of the link, close to the point where the slot is to end. This cutter is of helical design, and is made of high-speed steel. It is 2 1/2 inches in diameter to suit the width of the slot. After the link has been positioned and clamped properly in member *A* of the fixture, the cutter is extended through it, as shown clearly in Fig. 1, and connected with the machine spindle.

Member *A* pivots with shaft *B*, Fig. 3, as the table is fed horizontally, so as to mill the slot to the desired radius. The swiveling of member *A* and shaft *B* is produced by an accurate block, fastened to the front end of lever *C*, which moves along an accurate path ground in guide bar *D*. Lever *C* is fastened to the work-holding fixture, while the guide bar is adjustably mounted on bracket *E*, the latter being, in turn, fastened to a base held on the knee of the machine table. Hence, bracket *E* and the guide bar do not move horizontally with the table and the work-holding fixture.

The link slot may be milled to any desired radius by simply adjusting the guide bar to the proper angle relative to the line of table travel. Either concave or convex surfaces can be produced, depending upon the direction in which the guide bar is tilted.

Fig. 2 shows the milling cutter at the end of the cut. The heavy pile of chips on the table indicates the capacity of the machine for removing metal. The links are machine steel forgings, and in the operation, a feed of 3/4 inch per minute is employed with a cutter speed of about 100 revolutions per minute. Coolant is pumped copiously to the cutter during the operation from a large reservoir in the base of the machine. This fixture may be employed for milling the outside of the link, as well as the slot.

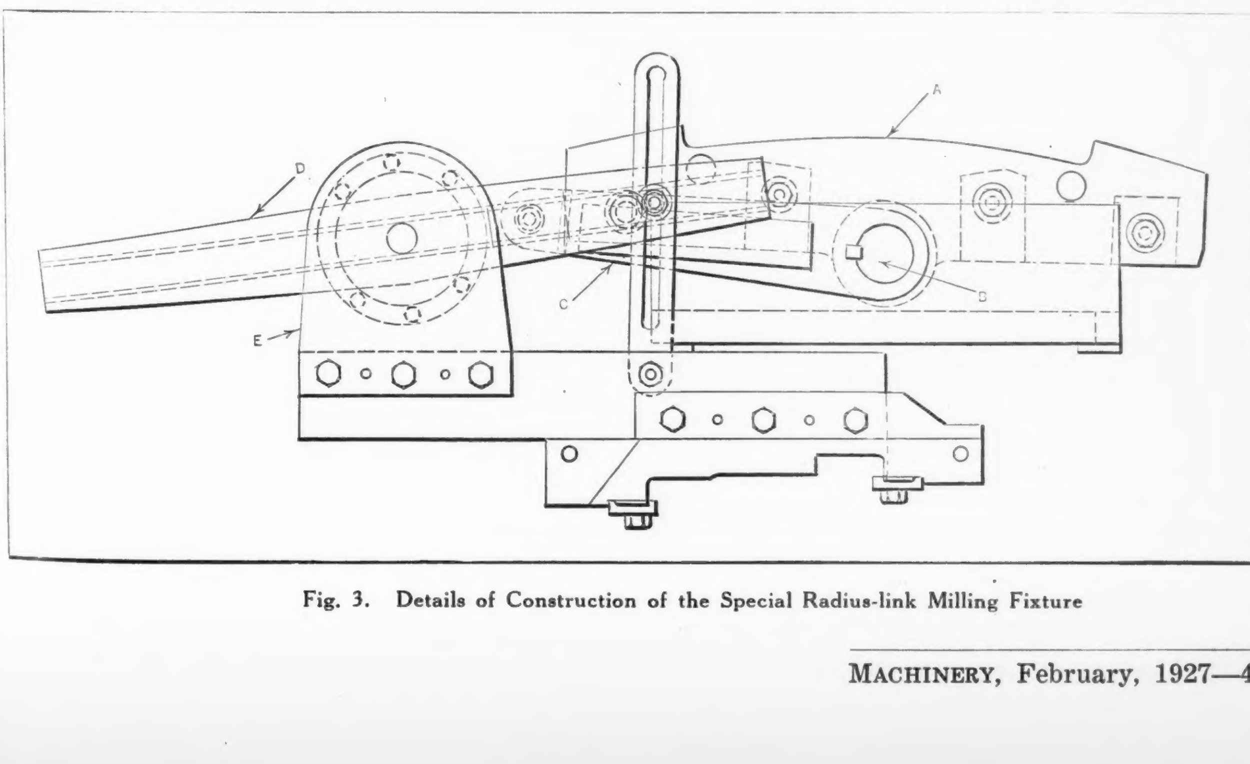


Fig. 3. Details of Construction of the Special Radius-link Milling Fixture

Notes and Comment on Engineering Topics

Originally conceived and developed as a war device, the Maxim silencer, which muffles the explosion of firearms, has found application in the industrial field. The silencer has been applied to oil-electric locomotives, doing away with much of the noise that has been accepted as a necessary evil in connection with engine operation. The new application was developed for oil engines built by the Ingersoll-Rand Co. to drive electric generators on oil-electric locomotives. The silencer is placed on the top of the locomotive, and traps the escaping engine exhaust without interfering with the release of the gases to the atmosphere.

An interesting development in electric arc welding equipment is to be found in the assembly of a General Electric gas-engine-driven electric arc welder on a Fordson tractor, for portable use at points remote from power lines. In this combination, the same gas engine drives both the tractor and the generator that supplies the current for the welding electrodes. The tractor is equipped with rubber tires so that it can be driven at a speed of from 15 to 18 miles an hour. When the tractor arrives at the job, all that it is necessary to do is to connect the generator to the engine by a belt, and the outfit is ready for welding.

The solidification of helium is reported from Holland, it being stated that Professor Keesom of the University of Leyden has succeeded in solidifying helium for the first time. Judging by the results of the experiments, it appears that at absolute zero a pressure of about 16 atmospheres would be required to solidify helium. The actual solidification took place at a temperature about 2.2 degrees C. above absolute zero at a pressure of 50 atmospheres, and at 4.2 degrees C. above absolute zero at a pressure of 140 atmospheres. Solid helium forms a homogeneous transparent mass which differs to an extremely small extent from the appearance of liquid helium.

From Switzerland comes the news that Dr. A. V. Blom, of Berne, has produced a new lead paint which affords permanent protection to iron. This paint, it is stated, is made by melting lead in an electric furnace and blowing air and other reducing gases through it, so that a dross or scale is produced which consists of colloidal or extremely finely divided lead dispersed in yellow lead oxide. When it is powdered and mixed with a specially prepared linseed oil, and applied to an iron surface, minute particles of lead separate out and gradually penetrate into the surface of the iron. The presence of the lead in the treated iron has been proved by photomicrographs and by chemical analysis. Iron objects painted with this new pigment have not shown any signs of rusting after prolonged exposure, or after being heated in steam. This discovery may lead to extremely important developments.

From time to time the scientific world has been startled by information to the effect that it has been found possible for scientists to change minute quantities of mercury into gold. It is believed that an atom of mercury consists of 80 electrons revolving around a nucleus, and that an atom of gold has only 79 electrons in its planetary system. Therefore, it would appear that if it were possible, by some means—for example, by the use of an electric current of an enormously high voltage—to change the planetary system of the atom from 80 to 79 electrons, mercury would be transmuted into gold. In a scientific discussion recently published by Haber, it is pointed out, however, that mercury, as well as numerous other metals, contains infinitesimal traces of gold, and that the minute quantities of gold discovered by scientists after their experiments were not likely to have been transmutations from mercury, but merely a precipitation of the minute quantity of gold that might have been present in the mercury. Hence, while it is by no means impossible that scientists will discover means for changing the number of electrons in atoms and thereby transform one chemical element into another, apparently such a discovery has not yet been made, and the dreams of the alchemists have not yet been fulfilled.

Niagara Falls is the largest power source of its kind in America—yet its entire capacity as developed on both the Canadian and American sides is less than half the present capacity of New York City's power plants. The combined capacity of the generating plants of this city already is more than 2,800,000 horsepower, and this does not include a million-horsepower plant now under construction to meet the ever-increasing electrical needs of the city.

Muscle Shoals has received considerable national publicity as a super-power plant—yet the entire present development at Muscle Shoals does not equal the capacity of two of the great electrical generators in the Waterside plants of New York, and, owing to the protracted drouth in the South, last summer's power capacity of Muscle Shoals does not equal that of a single generating unit of the older type in one of the Waterside plants. New York is the super-power city of the world, not only in terms of power-generating capacity but also in terms of power utilization. Thus last year the plants of this city generated 6,300,000,000 horsepower hours of electricity. This is almost equivalent to the electrical consumption of all of France, including that world-famous "City of Light"—Paris.

Routing Diversified Work Through the Shop

A System Applicable to a Medium-sized Shop Building Special Machinery or Doing a Jobbing Business

By EDMUND E. BURKE, Kent-Owens Machine Co., Toledo, Ohio

SYSTEMS for routing work through shops building special machines or operating on a jobbing basis should be sufficiently flexible to provide for all sorts of contingencies. Unless work is scheduled so as to meet the needs of individual machines and men, idleness of employes and equipment is certain to occur. Simplicity of the routing system is even more desirable in a shop of this type than in a plant engaged in the quantity production of standardized parts. An unusually simple system, by means of which the diversified products of the Kent-Owens Machine Co., Toledo, Ohio, are routed, is here described.

Scheduling the Work

Practically all the work is planned and the parts routed to the various departments by the personnel of the production office. First, the operations to be performed on a given job are carefully analyzed, and the departments in which the operations are to be carried out are decided upon. Then, a routing card, such as illustrated in Fig. 1, is made out in duplicate, set-up and allowed times being written in for each job; in addition, a standard time is specified for every job assigned to the milling department. This standard time is used in calculating the earnings of milling machine operators who work on an incentive payment basis, as will be described in a subsequent article. One of the routing cards is sent with a blueprint of the job to the first department marked on the card, while the duplicate is retained in a file in the production office.

FORM 154-10M-6-26

ROUTING CARD

PART NO.	ORDER NO.	QTY.	DATE
L - 2875	1 - A - 7680 - 2	12	9-23-26

PART NAME	MATERIAL
Turntable Spout	Iron Casting

MACH. OR DEPT.	OPER. NO.	OPERATION AND TOOLS	SET UP	STAND.	ALLOW	NO. O.K. / MAN NO.
19	1	Clean				
4	2	Mill pads	36.0	29.3	49.0	
2	3	Layout	24.0		30.0	
2	4	Drill and mach. top	30.0		24.0	
2	5	Hand tap and fit	12.0		10.0	
10	6	Inspect and stamp	18.0		24.0	
20-B	7	Fin. stores Sept. 30				

Fig. 1. Card Employed to Route Work to the Various Departments

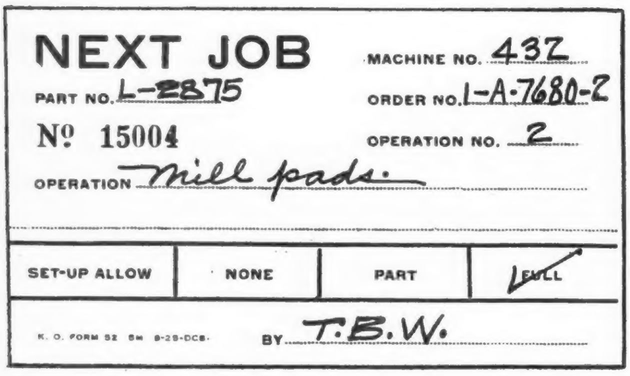
Actual routing of work to men and machines within each department is left to the discretion of the foremen. This arrangement makes the foremen personally responsible for keeping their men and machines busy, and relieves the production office of a great amount of detail. When a routing card is received by a foreman, he decides which man and machine shall perform the operation. Then the foreman makes out a "Next Job" slip, such as illustrated in Fig. 2, to authorize the operator to start on the job as soon as he has completed all the jobs that have been previously scheduled to him.

If the workman is required to make a full set-up of the machine for the operation, the foreman checks "Full" on the "Next Job" slip; if no set-up is required, he checks "None"; and if a partial set-up is necessary, he marks 1/2, 1/3, etc., in the space marked "Part." The foreman marks the slip in this manner merely to check the set-up time marked on the routing card. For instance, sometimes the operator can use the same set-up employed for the preceding job, and then he is not entitled to the set-up time specified on the routing card. The matter is beyond the control of the production office, because it is not possible to know beforehand the sequence in which a foreman will assign jobs to men and machines. In this particular, there is an opportunity for the foremen to favor their men unduly, but the likelihood of their doing so is small, since foremen are paid a premium which is based partly on the performance of the men who are under their supervision.

The foreman gives the "Next Job" slip, together with the routing card and blueprint of the job, to the operator, who places them in a clip upon his machine until he has finished the job he happens to be on and those scheduled to precede the job authorized by the slip. Six or seven jobs may be scheduled ahead for a machine operator, because in a shop of this type one man may finish several jobs in a day. As each job is finished, the next job to be performed is that called for by the "Next Job" ticket having the lowest serial number. When an operator runs out of work, it becomes necessary for him to ring up an "Idle Time" card, and then all the time intervening until a job is assigned to him is charged to overhead. The total idle time of any department reflects, to a considerable degree, on the efficiency of the foreman.

When an Operator Starts a New Job

When an operator is ready to start a new job, he takes the "Next Job" slip and the routing card of that job, together with the job slip of the work he has just completed, to the time clerk assigned to his department. A typical job slip is illustrated in


NEXT JOB MACHINE NO. 432
PART NO. L-2875 ORDER NO. 1-A-7680-2
Nº 15004 OPERATION NO. 2
OPERATION Mill pads.

SET-UP ALLOW	NONE	PART	FULL

K. O. FORM 52 5M 8-25-DCB. BY T.B.W.

Fig. 2. Slip Used to Authorize a Machine Operator to Start New Jobs

Fig. 3. The time clerk then makes out a job slip in triplicate for the job to be started, taking the necessary information from the routing card. He fills in only the spaces above the heavy solid line near the top of the slip, and below the heavy solid line in the lower right-hand corner.

Two of the slips have carbon on the back so that the three slips can be filled in simultaneously. One slip has black lines on it, and this slip is given to the operator, together with the routing card, to be held until the job is finished. The second slip has red lines on it, and this slip is placed in an inspector's box in the booth of the time clerk. When a job is completed, the black-ruled slip is returned to the time clerk, who places it in the inspector's box.

The third slip is made of manila cardboard, and is ruled somewhat differently from the other two slips, as shown in Fig. 4. It is used as a time card in connection with the "Periodograph" time recorder made by the Gisholt Machine Co. The card is placed in the recorder and "rung up," both when an operation is started and when the operation has been completed. Instead of recording hours and minutes, the clock marks periods that represent one-tenth hour each. The starting period of a new job should be identical with the stopping period of the old job, so that all the working time of the operator is accounted for. There is an individual box for each employe in the booth of the time clerk, into which the time card is placed while a job is in progress.

The Inspector's Slip

Inspectors call at the booths of the time clerks several times a day to collect the job slips. If only a red-ruled slip for a given job is in the box, the inspector is apprised of the fact that the job has been started and that he is expected to keep in touch with the job as it progresses through the department. However, when both the black- and red-ruled slips for a job are in the box, he is informed that that job has been completed and is ready to be checked. The inspector removes the slips to a box on his own bench for reference until the inspections are completed.

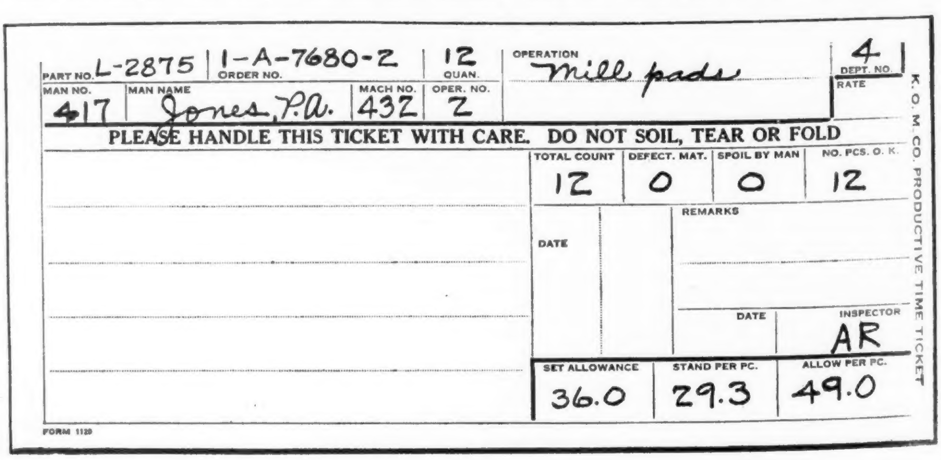
As an inspector checks work, he fills in the various spaces at the right-hand end of the black-ruled job slip, such as "Total Count," "Spoiled by Man," etc. This slip is then returned to the time clerk, who transfers the information to the proper spaces on the time card shown in Fig. 4. The clerk also fills in on this card the number of actual hours worked by the operator, the number of premium hours for which the operator is to be paid, etc. The number of hours worked is determined by merely subtracting the two periods rung up on the card and placing the decimal point properly. When the time clerk has completed his calculations, the card is sent to the cost department. Under this system, only three time clerks are required to take care of approximately 300 men, and these clerks keep other records as well.

When a man works more than one day on a job, a "continuation" time card is made out for each day, and the accumulated time for previous days is filled in under "Previous Hours," as shown in Fig. 4. Sometimes it is necessary to stop a man temporarily, and in such cases, the job slips and time card are marked to show that the operation has not been completed. New job slips and a new time card are made out for the operation when it is started again.

Each time an operator comes to the time clerk with a "Next Job" slip, routing card, and job slip of a previous operation, the time clerk asks him whether the operation has been finished. The job slips are then stamped accordingly. This is later verified by the inspector's report. If more than one operation must be performed in one department on a given job, separate job slips are, of course, made out for each.

Final Disposition of Routing Cards

After the last operation has been performed on a job, the routing card is sent to the cost department as a notification that the job has been completed. All routing cards are placed serially by the part number into a permanent file in the cost department, so that they can be readily referred to in the event that another order of the same part is put through the shop at a later date. After the desired information has been taken from the operator's time cards, these are punched according to the information on the cards, so that they can be readily sorted in an automatic machine. These cards are finally filed by the job order number.


PART NO. L-2875 | ORDER NO. 1-A-7680-2 | QUAN. 12 | OPERATION Mill pads | DEPT. NO. 4
MAN NO. 417 | MAN NAME Jones, P.A. | MACH NO. 432 | OPER. NO. 2 | RATE
PLEASE HANDLE THIS TICKET WITH CARE. DO NOT SOIL, TEAR OR FOLD

TOTAL COUNT	DEFECT. MAT.	SPOIL BY MAN	NO. PCS. O. K.
12	0	0	12

DATE REMARKS
DATE INSPECTOR AR

SET ALLOWANCE	STAND PER PC.	ALLOW PER PC.
36.0	29.3	49.0

FORM 1120
K. O. M. CO. PRODUCTIVE TIME TICKET

Fig. 3. Job Slip Made Out by the Time Clerk and Retained by the Machine Operator while the Operation is in Progress

Fig. 5 shows a slip that may be filled in only by the factory manager, shop superintendent, and production manager. It is used to change the routing of work scheduled to a department that happens to be rushed, in cases where the work can be done in a department that may be slack. Foremen are responsible for transferring the work from department to department, but in addition, there are "move" men who are under the direct supervision of the shop superintendent. A subsequent article will describe in detail the semi-payment system used in this plant.

* * *

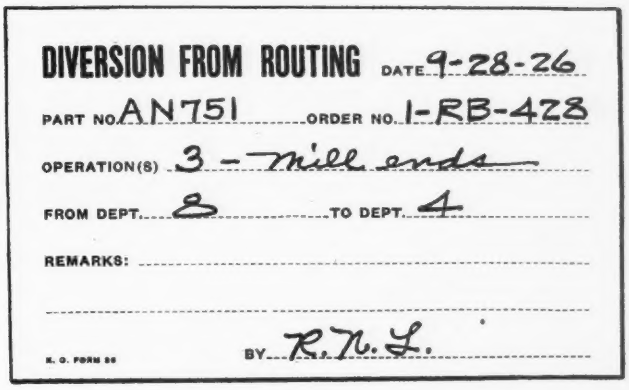
STANDARDIZING MAINTENANCE MATERIAL

By J. H. WICKMAN

The question often arises, "When is it advisable to use different material, that is, material made by some other manufacturer?" It should be the object of every railroad and industrial executive to standardize all kinds of maintenance material as far as possible without jeopardizing the service for which it is to be used. The first costs are, of course, far from being the only costs to consider in purchasing equipment.

As an illustration, if we consider oils, belting, motors, packing, lamps, pumps, insulating materials, starting compensators, or any of the hundreds of articles that may be made by different manufacturers—and in most cases one is as dependable as another—we will find one department specifying products of one manufacturer and another department specifying those of another make. This means that many more spare parts have to be kept on hand than should be necessary. In the case of the more common supplies, such as oils or belts, the same make could be used in each department with equally good results.

Unquestionably, there is an article that is theoretically correct for every place and purpose, but if we should select any 100 places where a given product is to be used, we would probably find that the article considered would be correct for 90 per cent of the places, while in 5 per cent of the places a better product should be used, and in the other 5 per cent, a cheaper article would be just as satisfactory. For example, if the use of a particular make of oil or grease was discontinued, and one made by some other manufacturer substituted, the only difference would be that part of the two 5 per cent classifications would change places with



DIVERSION FROM ROUTING DATE 9-28-26

PART NO. AN751 ORDER NO. 1-RB-428

OPERATION(S) 3 - Mill ends

FROM DEPT. 8 TO DEPT. 4

REMARKS:

K. O. FORM 86 BY R. N. L.

Fig. 5. Form Filled Out when it is Necessary to Change the Original Routing of a Job

part of the 90 per cent class. The total monthly cost of each article actually used would average up to practically the same amount.

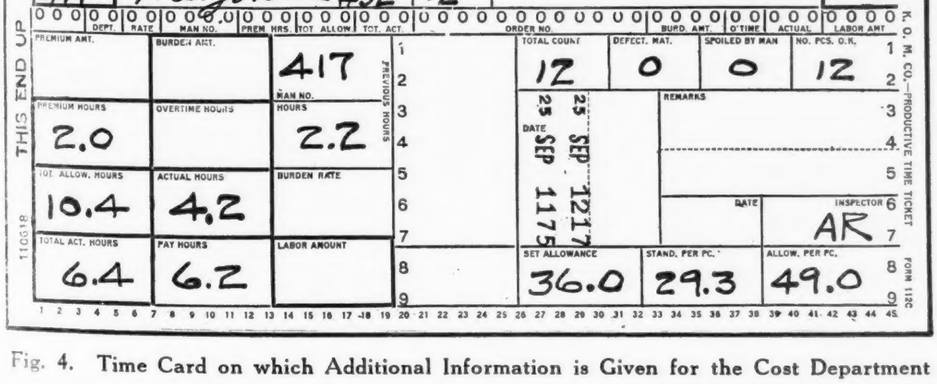
The saving in cost by standardizing material will appear in the store's stock; there will be less money invested in stock, less stock to handle, and less labor will be required when one kind or make of material is used in place of several different kinds. Where hundreds of articles are used, as on a railroad or in a large industrial plant, this saving may be a considerable amount.

There are many arguments against sticking to one kind of material. It is contended by manufacturers that it gives them no chance for competition. However, as long as material or articles are standardized and the percentage of maintenance troubles that can be directly traced to such material and articles is negligible, it is unwise and unprofitable as well, to substitute a different kind of material or product.

* * *

DRAFTING-ROOM STANDARDS

A paper was recently read by E. Kwartz, of Seattle, Wash., before a meeting of the Western Washington Section of the American Society of Mechanical Engineers, on a proposed standard for drawing sizes, and a system of numbers for mechanical drawings. In this paper, the author discussed present practices, and offered recommendations intended to overcome existing defects in drawing sizes, filing systems, and the identification of parts. Briefly, he offered objections to letter-size drawings, which have recently been adopted by many concerns because a standard letter file can be used for filing drawings and blueprints. He advocated an 18-by 24-inch size of drawing, and pointed out the disadvantages of a 24- by 36-inch size for detail drawings. The complete paper has been republished by the American Society of Mechanical Engineers, 29 W. 39th St., New York City, in the November, 1926, number of the society's publication, *Mechanical Engineering*.



PART NO. L-2875 | ORDER NO. 1-A-7680-2 | QUAN. 12 | OPERATION Mill pads | DEPT. NO. 4

MAN NO. 417 | MAN NAME P. A. Jones | MACH. NO. 432 | OPER. NO. 2 | RATE

DEPT. | RATE | MAN NO. | PREM. HRS. | TOT. ALLOW. | TOT. ACT. | ORDER NO. | BURD. AMT. | O'TIME | ACTUAL | LABOR AMT

THIS END UP

PREMIUM AMT. | BURDEN AMT. | MAN NO. 417 | PREVIOUS HOURS

PREMIUM HOURS 2.0 | OVERTIME HOURS | HOURS 2.2

TOT. ALLOW. HOURS 10.4 | ACTUAL HOURS 4.2 | BURDEN RATE

TOTAL ACT. HOURS 6.4 | PAY HOURS 6.2 | LABOR AMOUNT

TOTAL COUNT 12 | DEFECT. MAT. 0 | SPOILED BY MAN 0 | NO. PCS. O.K. 12

DATE 25 SEP 1175 | 25 SEP 1217 | REMARKS

DATE | INSPECTOR AR

SET ALLOWANCE 36.0 | STAND. PER PC. 29.3 | ALLOW. PER PC. 49.0

K. O. M. CO.—PRODUCTIVE TIME TICKET FORM 112C

110618

Fig. 4. Time Card on which Additional Information is Given for the Cost Department

Design and Mechanical Patents

Distinction Between These Two Classes and Important Facts About Design Patents

By LEO T. PARKER, Attorney at Law, Cincinnati, Ohio

IN the language of patent law, the word "design" does not mean the physical arrangement of the parts of a machine, but refers solely to its ornamental appearance. While it is true that many firms spend large sums yearly in obtaining mechanical, process, article of manufacture, composition and improvement patents, very little attention usually is devoted to protecting the exterior appearance or design of a new machine or other apparatus.

Design patents do not cost so much as other patents, and many of the technicalities are eliminated, which makes it more difficult in many instances, to avoid infringement of a design patent than of other patents. The Government fee for a short term or 3 1/2-year design patent is only $10, whereas the fee for all the other patents is $20 when the application is filed, and $20 within six months after the patent is allowed, thus bringing the total to $40. Also, the attorney's fee for preparing an application for a design patent usually is considerably less than the fee for other applications, primarily because the latter require a complete description of the operation of a machine or process, and numerous claims must be formulated in language that reveals legal technicalities on every hand; in fact, the mere wrongful omission or inclusion of a comma may defeat the purpose of a claim, and in later litigation, the validity or infringement of the patent may be denied. But a simple legal form, together with the required drawing, comprises a complete application for a design patent.

Design Patents Protect Exterior Appearance

A design patent gives its inventor a monopoly to the exterior appearance of the thing patented. For example, in a quite recently decided case, the Court said, in effect, that a design patent may be obtained by any person who has invented any new, original, and ornamental design for any article intended to be manufactured, but that the interior views, or other parts that will not be seen when the apparatus actually is performing its service, cannot be protected.

In another litigation during which the validity of a design patent of a machine was being tested, it was disclosed that an important part of the patent was an ornamental washer which was out of sight when the machine was in its intended use. The Court held that the patent did not protect the inventor against other persons manufacturing and selling a washer having the same appearance. In still another case, it was disclosed that an inventor had attempted to include cross-sectional drawings in an application for a design patent, but it was held that the interior views shown were not proper subjects for a patent.

Design Patents Do Not Protect Mechanical Principles

Another common source of litigation is where a design patent is obtained on a purely mechanical device which is made solely in consideration of the mechanical functions it is intended to perform. However, in view of the numerous previously decided cases, the law is well established that a design patent on a purely mechanical device is void and of no effect. Yet if the device is ornamental or attractive in shape, the mere fact that it performs mechanical functions is no reason why a valid design patent may not be obtained for it. For instance, recently a Court held a design patent infringed, and explained that the purpose of the design patent laws is to enable inventors to protect the exterior ornamental appearance of an article or device, and so long as it is formed to produce a desirable effect to the eye, the patent is valid, although the device is capable and intended to perform mechanical functions.

In another case, where the same point of the law was involved, the Court aptly explained this phase of the law by saying that a design patent "must relate to an article that is pleasing to the eye, but it is immaterial that the subject may embody a mechanical device, if the appearance or design is pleasing, attractive, novel, useful, and the result of invention." Where a pitman or connecting-rod was formed with ordinary graceful curves merely to relieve the sharp corners, it was held not the subject of a valid design patent, because its shape was primarily intended to effect mechanical advantages.

In another recent litigation, a design patent on an anti-skid motor vehicle tire tread was held void because, while the appearance of the tread actually was ornamental and attractive, the testimony introduced during the litigation proved to the satisfaction of the Court that the tread was formed solely in an endeavor to obtain the desirable anti-skid qualities. Thus, for a design patent to be valid, it is required that the exterior appearance of the thing be designed for the purpose of making it attractive to the eye, and not to increase its mechanical efficiency, because in the latter case, a mechanical or article of manufacture patent affords the proper protection.

Example Involving Both Mechanical and Design Patents

To convey the information more clearly, assume that a new type radial drill has been invented, and that it is to be thoroughly protected against infringement. A basic mechanical patent on the machine itself may be obtained. In addition to this patent, it is desirable to obtain separate mechanical patents on the various new operative parts, such as the elevating mechanism, the head,

the change-speed gearing mechanism, and the like. Therefore, a patent is issued on the complete new machine, comprising its different sets of mechanism and, also, separate patents to prevent other firms from making and selling the specific mechanical combinations of the machine; because, as is well known, infringement of any mechanical patent may be avoided by omitting an important element. For this reason, it is desirable, particularly with a large and complicated machine, to obtain separate patents on the various important combinations.

Only one invention may be claimed in a single patent; if a combination of the groups of elements is specified in one claim, the details of the parts of a single group or element cannot be specified in the following claim, and the details of another group or element in another claim, and so on. The groups of mechanism, with relation to one another, can be protected broadly in a single patent, but various applications for patents should be filed to obtain protection on the respective important details of each element or group of elements.

When a Design Patent May be Obtained

The machine may also be designed for ornamentation; for instance, there may be a peculiarly attractive base which performs the dual duty of supporting the machine and giving it a distinctive appearance; hence a design patent may be obtained to prevent other firms from copying the appearance of the product. Sometimes the housings of mechanical parts are good subjects for design patents, and can be made distinctive and attractive.

In a case where the validity of a casing or housing was being tested, the Court, in holding the patent valid and infringed, said that the appearance of the casing is "persuasively illustrative of an artistic sense of harmonious proportion, producing a pleasing effect . . . If there is doubt as to whether these departures constitute invention, it should be resolved in favor of the patent, not only by reason of the presumption arising from the grant, but also because the patented construction was adopted and retained on account of the novelty of the design . . . and furthermore, the popularity of the new design . . ."

Another example of a valid design patent is the well-known steam radiator. In deciding this case, the Court said, in effect, that the inventor gathered together in a unitory and harmonious structure the various features of the old art, including the foliated scroll in simple chaste and modest form, and has thus made use of the inventive faculty, and the patent is valid.

Some Design Patents Are Almost Trademarks

The public may learn to recognize the "make" of a machine by the ornamental appearance of the design patented part; but in any event the housings or other portions that are designed partly to make the machine attractive, are of sufficient value to justify the expense of obtaining protection by means of a design patent. In a recent litigation, after the patent of a well-known product had expired, the design was adopted and used by another manufacturer. Legal proceedings were instituted against the latter user to prevent the adoption and use of the design, on the grounds that its appearance had become so well established in the minds of the public that the make of the machine on which it had been used for so long a period was generally recognized by the design. But the Court held there was no recourse after the patent expired, even though the design was so well known to the majority of people that it indicated the name or make of the machine on which it had been used for so many years.

Proving Infringement of a Design Patent is Easy

While considerable controversy over the meaning of the claims of a mechanical patent is necessary in proving infringement, the matter of obtaining a judgment against the infringer of a design patent is comparatively simple, where the infringement actually exists. Since a design patent relates to the exterior appearance of an article, the method adopted by the Courts in determining whether one design infringes another is simply to compare the similarity of the two things in controversy.

For illustration, in a recent case the Court said "Considerable evidence was introduced relating to the history of the art and to the basic principles, lines, and contour of each design, all of which is helpful to the Court in the disposition of the question involved, but, where a question of an infringement of a design patent is presented, oral evidence is never so satisfactory as the judgment of the eye, upon actual view of the original design and the one claimed to be an infringement thereof."

In another case a Court, in holding a manufacturer liable for infringement, said: "We hold, thereof, that if in the eye of an ordinary observer . . . two designs are substantially the same, if the resemblance is such as to deceive an observer, inducing him to purchase one supposing it to be the other, the first design patented is infringed by the other." In another case, where a similar point of the law was involved, the Court said, "In the absence of testimony to establish the identity, the Court will, upon introduction of the admitted article, determine the question of infringement by comparison."

Penalty for Patent Infringements

The penalty for infringing a design patent is somewhat different from that for infringing other patents. For instance, an infringer of patents, other than designs, is liable for damages and profits, and if the infringement is done purposely and maliciously, the Court may treble the amount. The liability for infringing a design patent is fixed by statute. The least penalty is $250, and may be considerably more, because where the infringement is extensive, the infringer may be compelled to pay the patentee full damages, as well as all of the earned profits. However, to recover $250 where probably only a single copy is made, it is required that the owner of the design patent prove to the satisfaction of the Court that the infringer knew of the patent or had sufficient information concerning it to make him realize that he should have obtained complete information relative to it. If the patentee cannot prove these facts, the infringer is liable only for damages and profits.

Patentable Design must be Attractive

Occasionally a firm may be manufacturing a machine, the mechanical parts and principles of which are old and, therefore, unpatentable, but a design patent may be obtained on the new, ornamental and attractive appearance of the device or any part of it, irrespective of the fact that the mechanism is old, if the design is new.

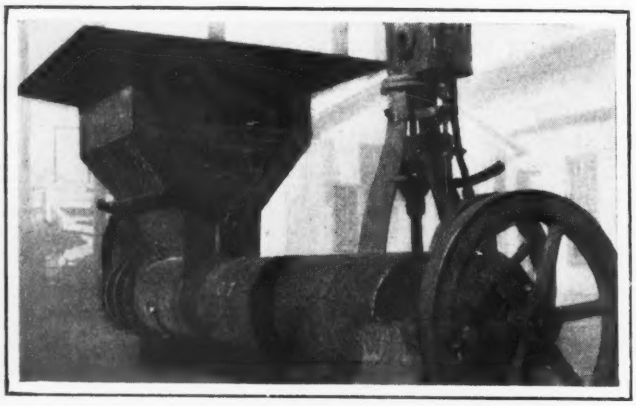
Where the validity of a design patent of a mechanical tool was being tested, in holding the patent invalid, the Court explained the requirements of a valid design patent by saying: "To establish the validity of the design patent, and to entitle the inventor to protection, he must establish a result obtained, which indicates, not only that the design is new, but that it is attractive. It must involve something more than mechanical skill . . . . We cannot agree that it has such a pleasing effect imparted to the eye as to create beauty or attractiveness, or to make it ornamental. It provides for new utility. Design patents refer to appearance."

* * *

AN OXY-ACETYLENE WELDED MACHINE

The accompanying illustration shows a cement mixer built at one of the western oil fields by making all permanent joints by the oxy-acetylene welding method. It has the advantage of being absolutely tight in all seams, and as it is constructed wholly from steel, it has unusual strength. A hopper is made from 1/4-inch steel plate, cut to shape with a cutting blowpipe. The funnel-like neck is welded to a hole of corresponding shape cut in the top of the barrel by the blowpipe. Webs welded on each side give additional support.

One end of the barrel is half enclosed by a welded semicircular plate through which the main shaft extends to a flywheel. The other or driven end of the screw is encased by a welded flange to which is affixed a bolted removable head. Even the mixing screw is constructed with blades cut, shaped, and welded to the shaft by the oxy-acetylene blowpipe, and welded brackets hold the mixer rigid on the I-beams on which it is mounted. The entire machine was made largely from salvaged material. We are indebted to *Oxy-Acetylene Tips*, published by the Linde Air Products Co., for the information published in the foregoing. It is evident that machines of this kind can be built in localities where regular machine shops are not available, as the equipment needed is simple.

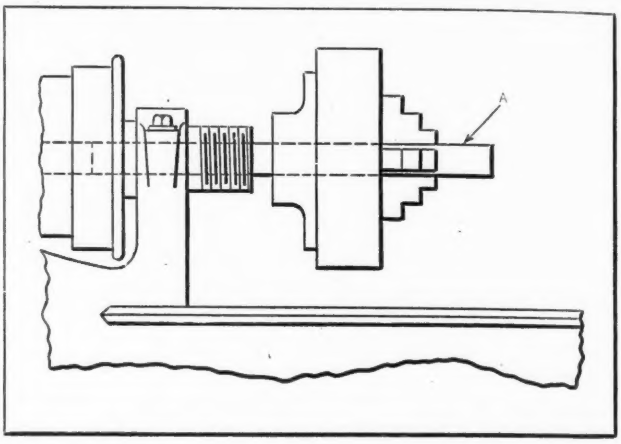


A Cement Mixer with all Permanent Joints Welded

SUPPORT FOR LATHE CHUCK

By CHARLES KUGLER

The swinging support for a lathe chuck described on page 41 of September MACHINERY is very good, and should be provided on all lathes having heavy chucks. As there are many lathes that are not so equipped, the writer believes that the following method of putting on and removing a heavy chuck will also be of interest. The method consists of placing a round bar *A* in the lathe spindle.



Method of Supporting Heavy Chuck when Screwing it on Spindle

This bar should be about the same size as the hole through the spindle. The chuck is then placed over the projecting bar, and the jaws tightened on the bar. This automatically lines up the chuck with the lathe spindle, so that it can be readily screwed on. In the case of turret lathes, a boring-bar may be placed in the turret and the chuck tightened on this bar to bring it into line with the lathe spindle.

The importance of employing a suitable means for placing heavy chucks on their respective spindles will be realized when the shears of almost any large lathe are examined and when the injuries to the hands of lathe workmen resulting from the dropping or slipping of heavy chucks are noted. The bar shown at *A* in the illustration can also be employed in removing the chuck from the lathe. In placing a chuck on the spindle, it is sometimes the best plan to put the bar *A* in the chuck first, and then insert the end of the bar in the hole in the lathe spindle. When this is done, the bar serves as a good gripping surface and facilitates lifting the lathe chuck from the floor.

* * *

DETAIL DRAWINGS WITH BIDS

We are informed that the board of education of a Canadian city has recently invited bids on a number of lathes for a school in that city. The bidders are asked to attach detailed working drawings of the machines they offer, when submitting their bids. This request is not only very unusual, but introduces a practice that is contrary to the consensus of good business opinion in the machine tool industry. It is not generally considered good business practice to furnish complete working drawings of a machine that has already been bought, and it would be still less desirable to supply detail drawings when merely submitting a bid.

Making Molds for Die-Casting

By JACOB H. SMIT

DIE-CASTING is a comparatively new industry. Started only about thirty years ago, it is now an important factor in the production of many articles, such as horns for phonographs, parts for automobiles, player pianos, moving picture machines, dairy machinery, automatic vending machines, electrical instruments, vacuum sweepers, typewriters, and adding machines. Die-castings are produced by forcing molten metal under pressure into steel molds or dies, the cavities of which have the shape of the piece required.

Parts produced by die-casting require practically no machining, except in the case of complicated castings, which may sometimes require the drilling or tapping of holes that cannot be readily formed by the die. Occasionally, cast threads must be chased and fins removed.

The metals used are lead, tin, antimony, zinc, aluminum, copper, iron, and magnesium. The alloying of the different metals must be done by a trained metallurgist. If the mixture is not made correctly, the castings are likely to corrode and disintegrate after a few years. The writer has samples of die-castings made ten years ago that are as good as new.

Needless to say, the designing of the molds must be done by an experienced man. The making of the molds calls for accurate machine work and a knowledge of various kinks peculiar to this class of work. Breaking of the castings is one difficulty experienced with molds that are not correctly designed or properly machined. Molds for the white metal alloys, which melt at a low temperature, are made from hammered machine steel. Molds for aluminum die-castings are made from chrome-vanadium steel. The weight of molds used for die-casting varies from about 20 pounds to 3000 pounds.

Preparing Die-blocks

The location of the parting line on a die-casting mold depends on the shape of the casting required. As a rule, the parting line is made on a corner or where it will be the least noticeable. The various parts of a die for producing two elbows at one time, like the one shown at *W*, Fig. 2, are shown in Fig. 1. The assembled die is shown in Fig. 2. After facing the blocks *A*, *B*, *C*, and *D*, they are ground smooth on one side. The top die *C* and top baseplate *D*, and the bottom die at *B* and baseplate *A* are assembled and held together with 1/2-inch dowel-pins. The sides of the dies and baseplates are then carefully squared up, in order to facilitate the subsequent machine work. The cast-iron block *F* is also machined.

Machining the Die Cavities

After the block *F* is secured in place by dowels, a button is located at the intersection of the two die-blocks *B* and *C* at the required distance from the end of the blocks. This button serves to locate the blocks for drilling the core hole at *G*, Figs. 1 and 2. Instead of using a button, a center-punch mark can be made by employing a punch-holder such as shown at *R*, Fig. 1. Time will be saved by using two vernier depth gages for locating the button or centering block *R* while an assistant tightens the screw that holds the button or taps the center-punch. By using the vernier depth gages, a punch mark can be located within 0.001 inch of the exact position in less than five minutes.

After the die-blocks are centered, they are mounted on a lathe and a hole of the right size is drilled to the required depth. By drilling and boring, this member is finished to the shape indicated at *J*, Fig. 1. The cavity thus produced must, of course, have the shape of the elbow to be die-cast. A micrometer stop is used to gage the depth of the hole.

In order to obtain a smooth cavity, the boring tool may be placed upside down in taking the finishing cuts, using a very fine carriage feed by knocking the feed-screw handle around about 0.001 inch for every revolution of the work. The tool should not be allowed to remain idle in the corners, as this will result in under-cutting the work. It is advantageous to turn part of a radius of the elbow cavity with a radius turning tool held upside down in order to prevent chatter marks. Some toolmakers drill two holes in the under block to enable it to be clamped to the baseplate. This allows the top block to be removed, in order to inspect the progress made in boring out the cavity.

Matching Cavities

After the cavity has been finished in one side, the blocks are turned end for end and the cavity finished at the opposite end. For the other sides of the elbows, holes like the ones shown at *K*, Fig. 1, are drilled. The buttons or centering blocks are used to locate these holes on the cast-iron block *F*. After the holes have been bored to the required depth, the block *F* may be removed while the cavities in the mold blocks are finished to the required shape. When the cavities are finished, the 1-inch or 7/8-inch pinion hole can be laid out and drilled, dummy plugs being placed in the core holes. A 1/2-inch hole *L* is drilled in block *F*, Figs. 1 and 2, and tapped to receive a screw for holding the core clamp in position against the pressure exerted by the hot metal.

The blocks *B* and *C* are next taken apart, and their contact bases are coated with bluestone. The outlines of the elbows are now laid out to the required radius, and the blocks located on a milling machine table. The radius section of the cavity is then milled out with a homemade end-mill of the required shape. The end-mill should be made at least 0.010 inch thinner on the sides to prevent it from making the holes too large. After as much

of the metal as possible has been removed with the end-mill, the cavity is finished with curved hand scrapers and chisels, the final finish being produced with riffle files, care being taken to have the outlines in the two die-blocks accurately lined up. The 5/8-inch sprue hole M, Figs. 1 and 2, is drilled and reamed. It might be well to mention here that 1/32 inch should be left for reaming a deep hole having a diameter over 1/2 inch.

Making the Cores

The cores are next machined to the required length and size. The cores used in the end holes G are made, as shown at O, with slotted heads which receive link Q of the toggle-joint operating lever V. The cores for the holes K are made as shown at P. The bodies of the cores are made sliding fits in the holes and are tapered about 0.001 inch per inch on the portions that fit the holes in the mold cavity. The ends of the cores are, of course, beveled off so that they make close contact where they meet within the die cavity. The two cores P have rack teeth cut on the body section. The small spot-drilled holes in the bodies of the cores are filled with graphite. The toggle holders and links are made as shown at Q and R, Fig. 1.

The gates are next milled about 1/8 inch deep, being located near the sprue hole and tapered down to about 0.015 inch where they meet the elbows. The gate is always left small, the right depth of opening being found by trial when casting. The air vents are milled about 0.004 inch deep, with a width of about 1/2 inch. These vents permit the air to escape when the metal is forced into the mold. They vary from 1/2 inch to 2 inches in width, according to the size of the casting made. Sometimes thin washers are placed on the dowel-pins in order to provide an air space.

A clearance of about 0.001 inch is left between the ends of the cores to allow for expansion when they become heated. The inner ends of the cores are draw-filed and smoothed before the die and mold are assembled. This prevents the castings from sticking or breaking.

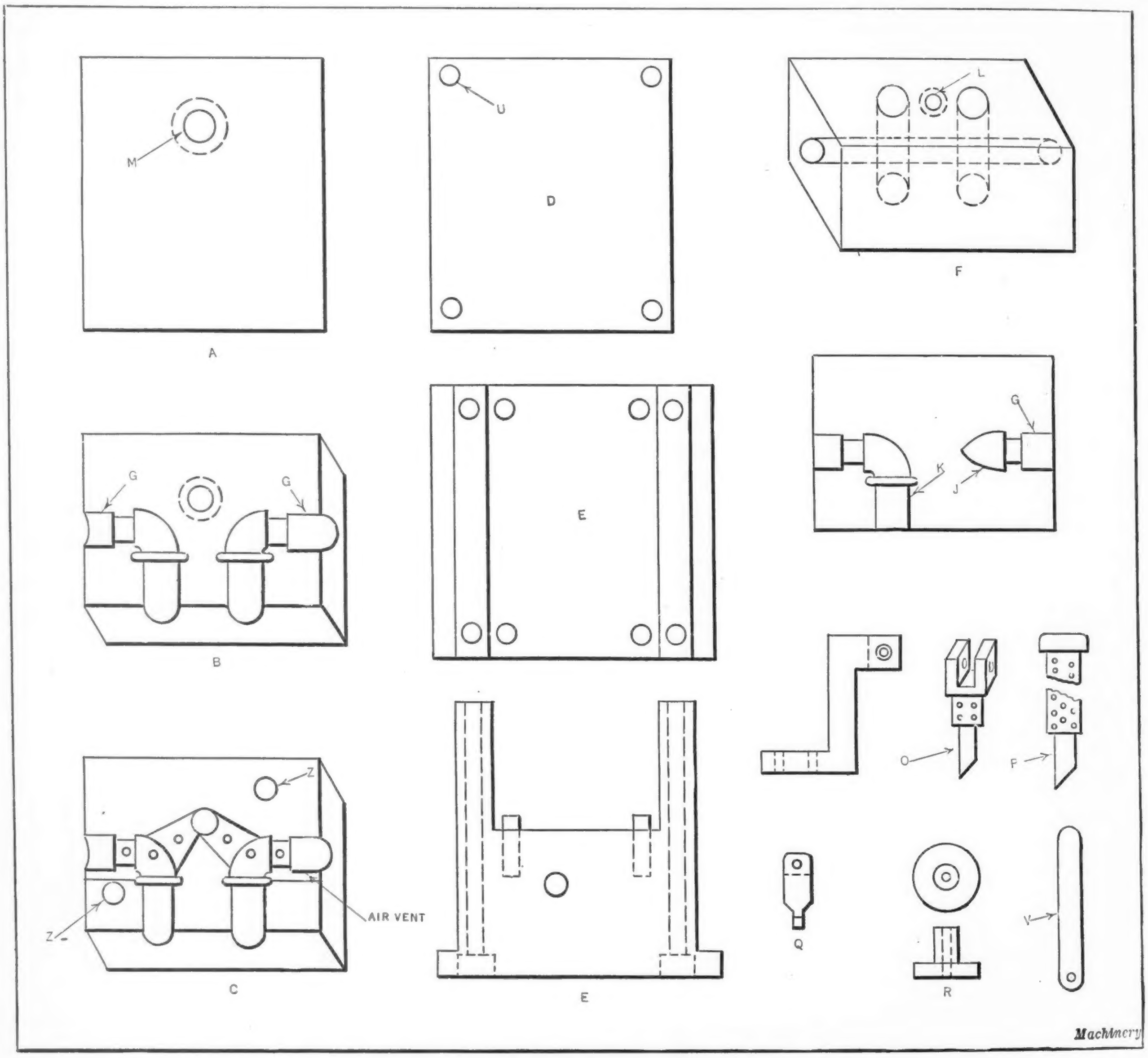


Fig. 1. Parts of Die-casting Mold

Making the Ejector Box

The ejector box E, Figs. 1 and 2, is made from cast iron and finished all over. The two racks that operate the cores K are riveted to the plate S, Fig. 2. The plate H is secured to plate S by machine screws. The 1-inch pinion which fits the hole T and is provided with a large operating lever

serves to move the ejector plates up and down. The ejector plate *H*, when lowered, rests on four plugs driven into the box *E*. The baseplate *D*, together with die-block *C*, are clamped on the ejector box and the four screw-holes *U* drilled and tapped. After securing these members in place, ejector pin-holes are drilled through the block *C* and the base *D*. Frequently safety lining pin-holes, such as shown at *Z*, Fig. 1, are drilled and reamed through members *C* and *D*. The ejector pin plate is next moved up and the top plate *S* spotted for drilling.

The baseplate *D*, Fig. 2, is next removed from the ejector box, and the top plate *S* of the ejector pin plates removed, drilled, and reamed and countersunk on the other side. The ejector pins are then cut off and riveted over, after being driven into the ejector pin plate *S*. The riveted ends are then filed flush with the surface of the plate. The pins are made a sliding fit in the mold block.

After the die-block and baseplate have been fastened to the ejector box, the ends of the ejector pins are filed to suit the form of the casting cavity. The holes in the molds for the cooling water are drilled and tapped to receive the water pipe fittings. The cores operated by the toggle lever and the toggle holders are drilled to receive the 1/4-inch pivot pins. The levers *V* are clamped in position with the required pressure on the cores and the 1/4-inch pin-holes drilled and reamed. The cutting off of the sprue cutter and the cleaning out of the holes and finish-tempering, completes the mold.

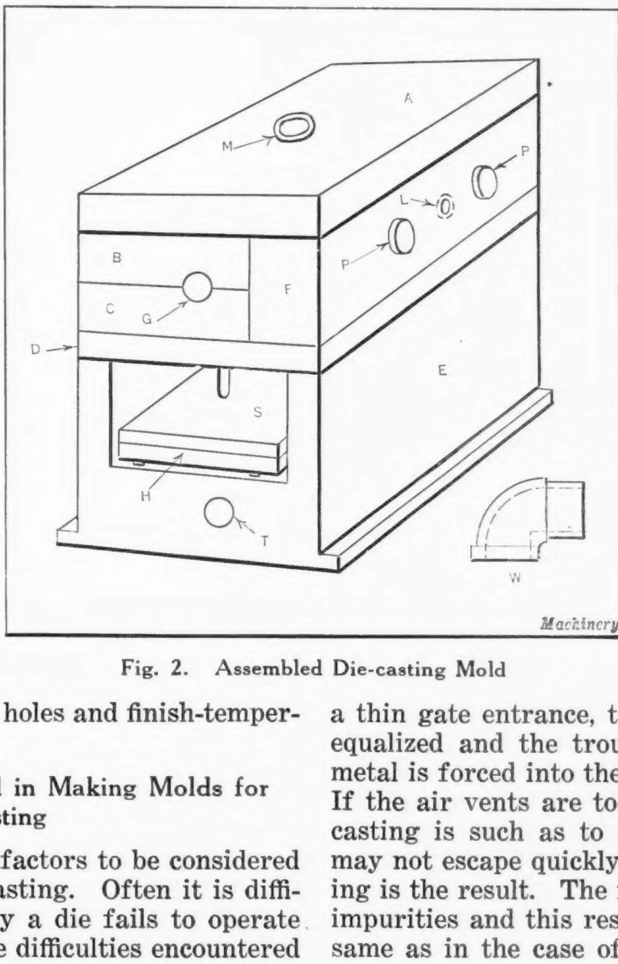


Fig. 2. Assembled Die-casting Mold

Factors to be Considered in Making Molds for Die-casting

There are a great many factors to be considered in making molds for die-casting. Often it is difficult to find the reason why a die fails to operate satisfactorily. Some of the difficulties encountered by the writer and the methods employed in overcoming them are described in the following. The finish on the cavity of a die-casting mold is a factor of considerable importance. The finish should be smooth, but it need not be so fine as that required for molds employed for condensite or similar compositions. A fine file finish without scratches is generally satisfactory for die-castings. Before using a mold, the mold cavity and cores are treated with an acid, which gives the surfaces a film that prevents the die-casting metal from sticking to the mold when hot.

Molds with straight sides should have a slight draft. As a rule, 0.001 inch to the inch gives a sufficient draft for dies used for the low melting point, or white metal alloys, as these metals shrink away from the mold cavity walls when cooling. In the case of a die having inner walls, as for instance, a die for bearings having a flange, the castings shrink close or tight to the inner surfaces. For work in this class, care must be taken to provide more metal, in order to prevent trouble in removing the castings from the molds. In some cases, cores require a taper of 0.005 inch to the inch in order to prevent the casting from sticking. Trouble from this source is often experienced in the case of zinc or aluminum castings.

Causes of Cracking

If the metals that form the alloy are not mixed correctly or the shape of the casting is irregular or not of uniform thickness, strains are set up in cooling that may cause cracks to develop in the casting, no matter how quickly the cores are pulled and the mold opened. In one instance, a die used for casting an aluminum magneto timing housing gave considerable trouble in this respect. Every casting cracked on the narrow side. All the die-makers in the shop were given this die to repair at one time or another in an attempt to find the trouble. The trouble was not found, however, at that time. Sometime after it occurred to the writer that the cracking was due to the varying thickness of the part. One side cooled off quicker than the other, thereby setting up strains.

If a hole had been made in the die close to the side of the thin section and there had been a thin gate entrance, the cooling would have been equalized and the trouble eliminated. When the metal is forced into the mold, the air is driven out. If the air vents are too small or the shape of the casting is such as to leave deep pockets, the air may not escape quickly enough, and a porous casting is the result. The risers take up the dross and impurities and this results in a better casting, the same as in the case of castings produced in sand molds.

Life of Molds

Molds for use in the production of aluminum dies give more trouble than those employed for softer metals, owing to the higher heat required to melt alloys of aluminum and copper, the temperature being around 1200 degrees F. Obviously, the molds used for metal having a higher melting temperature have a shorter life. For the aluminum alloys, molds made from chrome-vanadium steel have been found to give the best service. However, molds made from this material will produce only a certain number of castings before showing signs of failure. After from 4000 to 15,000 castings are produced, the mold cavity develops cracks, owing to the quick expansion and contraction of

the upper mass of metal where it comes in contact with the hot metal. The cracks slowly become larger until at last many ridges begin to appear on the castings. The useful life of the mold ranges from 25,000 to 200,000 casting operations. The draft required on cores for aluminum die-castings is about 0.015 inch per inch of length and diameter. The draft required for the side walls is about 0.005 inch per inch of height. Aluminum castings shrink about 1.4 per cent in cooling.

The method used in forcing the metal into the molds has considerable effect on the operation of the mold. On some casting machines, direct air pressure is used on the hot metal. A certain amount of air mixes with the metal, causing air bubbles or blow-holes. This has been successfully overcome on the later style machines.

Another more serious annoyance is the effect of the hot aluminum alloy on the cast-iron containers. Certain non-metallic compositions, also small pieces of scale from the melting pot, may become mixed in the alloy, producing the hard spots sometimes found embedded in an aluminum casting. Ordinarily, however, these spots are not objectionable. With an increase of iron in the alloy, the temperature increases, and the molten metal becomes more sluggish when filling the mold.

With heavy aluminum castings in which the volume exceeds the volume of metal in the gate, the iron does not cause much trouble. But with a long gate and small castings, the presence of iron becomes more objectionable. The comparatively large gate that is returned to the melting pot dissolves a certain amount of cast iron each time, and as the cast iron content increases, the quality of the metal is impaired. Ordinarily, the metal should not be used for die-castings when the iron content exceeds 3 per cent.

Air Pressures Employed

The air pressure used for die-casting molds ranges from 100 to 1500 pounds per square inch. The lowest pressures are, of course, used on the large heavy castings. White metal and aluminum require from 100 to 500 pounds per square inch, 300 pounds being the average pressure for small castings. For bearing castings, a pressure of 500 to 1500 pounds is used, in order to give the metal greater density. When such high pressures are employed, the molds must be solidly constructed.

Molds Should be Kept at Correct Temperature

The temperature of the molds should be carefully regulated. Cold molds often produce castings having surfaces of mottled appearance. The rough surfaces are probably caused in some cases by the sweating of the cold surfaces of the mold cavities when they come in contact with the hot metals. If the metal is too hot, blow-holes, cracks, excessive shrinkage, and porousness may result. The temperature of a mold can be regulated by circulating water through holes drilled in the mold.

Scored Mold Cavities

Thousands of castings are sometimes made from one die or mold without experiencing any difficulties; on the other hand, the cavity in the mold may become badly scored after only a few castings have been made. In some cases, the scored spot can be smoothed up with a riffle file, but in other instances, it is necessary to remove the mold from the machine in order to smooth up the scored surface. Some molds are difficult to repair while they are in the casting machine, because of the small space between the two halves of the mold, the depth of the cavities, and the hot parts of the machine close to the mold.

One theory of the cause of scoring, in the case of aluminum castings, is that the iron or scale makes a hard spot on the white metal. At first thought, this seems impossible. Nevertheless, the writer read of one instance in which lead and zinc, both soft metals, when mixed in a certain proportion produced a glass-hard material that could not be touched with a file. It seems possible that the same thing might happen in the case of an alloy of aluminum and iron.

A certain spot in the casting may have a different composition from the remainder of the casting due to impurities, slag, dross, or foreign metals. Another cause may be the forming of little fins in the mold due to air vents, a slight warping of the mold, or corners knocked or worn off the mold or cores. Most of the fins are blown away when cleaning the mold, but if one remains in the cavity it may drop in a certain spot and stick there. When the metal is forced into the mold, the scale that adheres to the cavity is pressed more tightly against the mold surface under the force of several hundred pounds pressure. Before the scale becomes melted, it may scratch the interior of the die slightly. When a small bruise is once started, it quickly develops into a larger scratch, with the result that after a few more castings have been made, the surface becomes badly scored.

* * *

ELECTRIC ARC-WELDED BUILDING

The five story electric arc-welded building erected by the Westinghouse Electric & Mfg. Co., at the Sharon Works of the company, is the first strictly multi-story skeleton steel structure designed for arc welded construction. The floor dimensions of this building are 70 by 22 feet, and the height will be 80 feet. The noteworthy feature in connection with its erection has been the absence of noise from riveting. Another feature that is pointed out by the company building the structure is that the welders now working on the building were formerly riveters, given three weeks' training in welding.

The new building is the outgrowth of experiments by welding engineers covering a period of years. Less steel is required in a welded than in a riveted building, the Sharon building, for example, requiring 700 tons of steel, while it is stated that a similar building of riveted construction would have required 800 tons. The steel for the structure was fabricated in the plant of the American Bridge Co. at Ambridge, Pa. The columns were all welded in the shop before delivery to the construction field, the same as in riveted construction. The steel girders of the new building, according to Gilbert D. Fish, consulting engineer of the Westinghouse Electric & Mfg. Co., are specially designed for arc welding.

Methods of Holding Tools and Cutters

Second of a Series of Articles

By FRED HORNER

THE first article of this series, in December MACHINERY, page 253, outlined some of the more important factors to be considered in the application of various types of clamping devices for holding tools and cutters. Some typical designs were also illustrated and described. The present article is a continuation of the description of typical tool-holding devices.

At *A*, Fig. 6, is shown a trepanning tool-head used on a plano-miller for cutting circular grooves. It will be noted that there are three pairs of tool slots of different depths, which permit the tools to be set for cutting grooves of three different diameters. The outer ring, which contains the clamping screws, can be revolved on the head to bring the screws opposite the slots in which the tools are held.

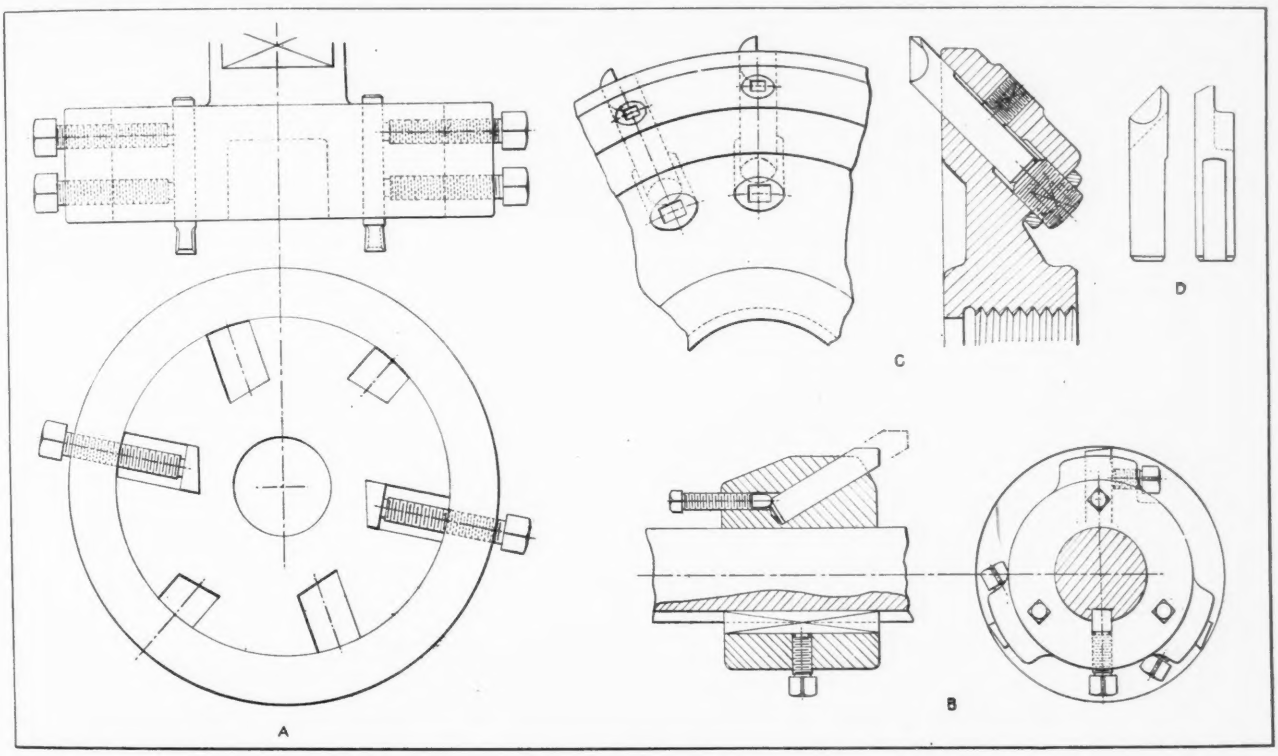


Fig. 6. Methods of Holding Cutters in Boring and Grooving Heads

Slotted Tool-blocks

Slotted blocks constitute a very important group of tool-holders, being mainly employed on turret lathes of the flat turret type and on the new multiple tool lathes developed within the last few years. The simplest holders of the multiple type have no end adjusting screws, as shown at *F*, Fig. 7. The holder shown in this view is employed on the Acme flat turret lathe, and has a central hole for a boring-bar or pilot, and two rectangular tool openings for square or rectangular shank boring or facing tools.

Multiple Block Holders

Tool-blocks are made to hold one or any number of tools required. A number of the single or multiple blocks may be grouped together or a one-piece block may be used to hold the entire group of tools. The single tool-holder is preferable for general purposes, as the blocks can be grouped as required. When the tools have to be grouped very close together, however, or are of the fine narrow type, a solid block type of holder is preferable, particularly for production work.

A simple duplex tool-block is shown at *D*, Fig. 7. Two or three clamping screws are provided for each tool. When the blocks are required to be grouped together, the T-slot method of fastening is not so convenient as other methods, unless the T-slot is parallel with the ways, in which case any desired spacing of the blocks is permitted. When the block is secured by a bolt in the T-slot, as shown at *D*, extremely close grouping of the tools is impossible, owing to the space taken up by the bolt.

The tool-blocks used on the ways of Fay automatic lathes are secured in place by a dovetail joint, as shown at *A*, Fig. 8. This construction brings the clamping screws at a low point on the tool-blocks, which are hardened and can be reversed on the dovetail tongue to permit the tool slot to face either the headstock or the tailstock, as required. It will be noted that the third holder

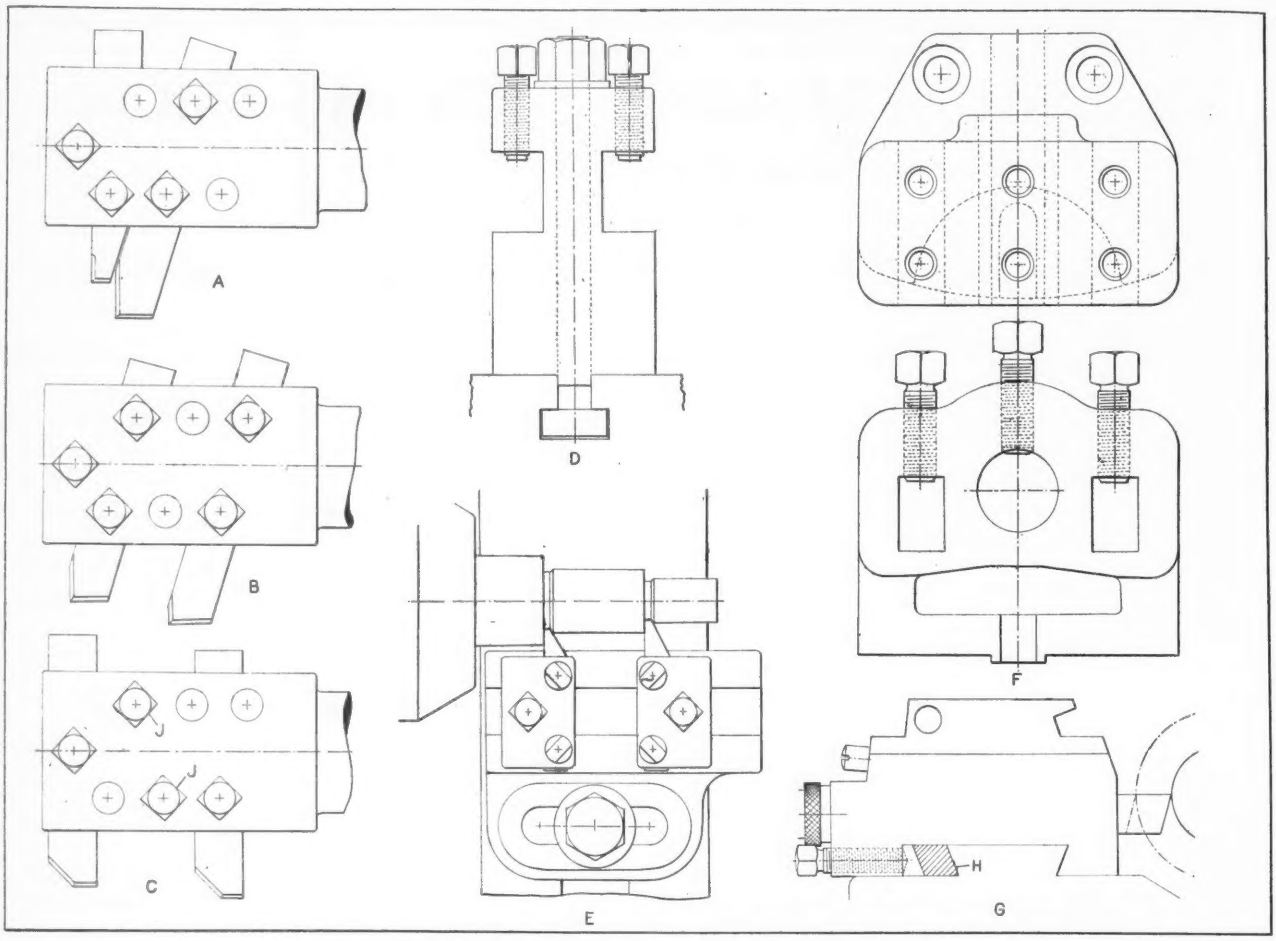


Fig. 7. Holders for Turning and Boring Tools

from the left-hand end of the group shown at *A* has a closed slot. The blocks at the extreme right-hand end of the group have angular side slots, one of the holders being designed to allow the tool to be directed to the right and the other to the left. The end view shows a thrust block carrying a rear adjusting screw. One of the vacant screw holes may be used for securing the coolant pipe or nozzle in place.

A small tool-block provided with a longitudinal T-slot, on which a pair of blocks for holding necking tools are secured, is shown at *E*, Fig. 7. This

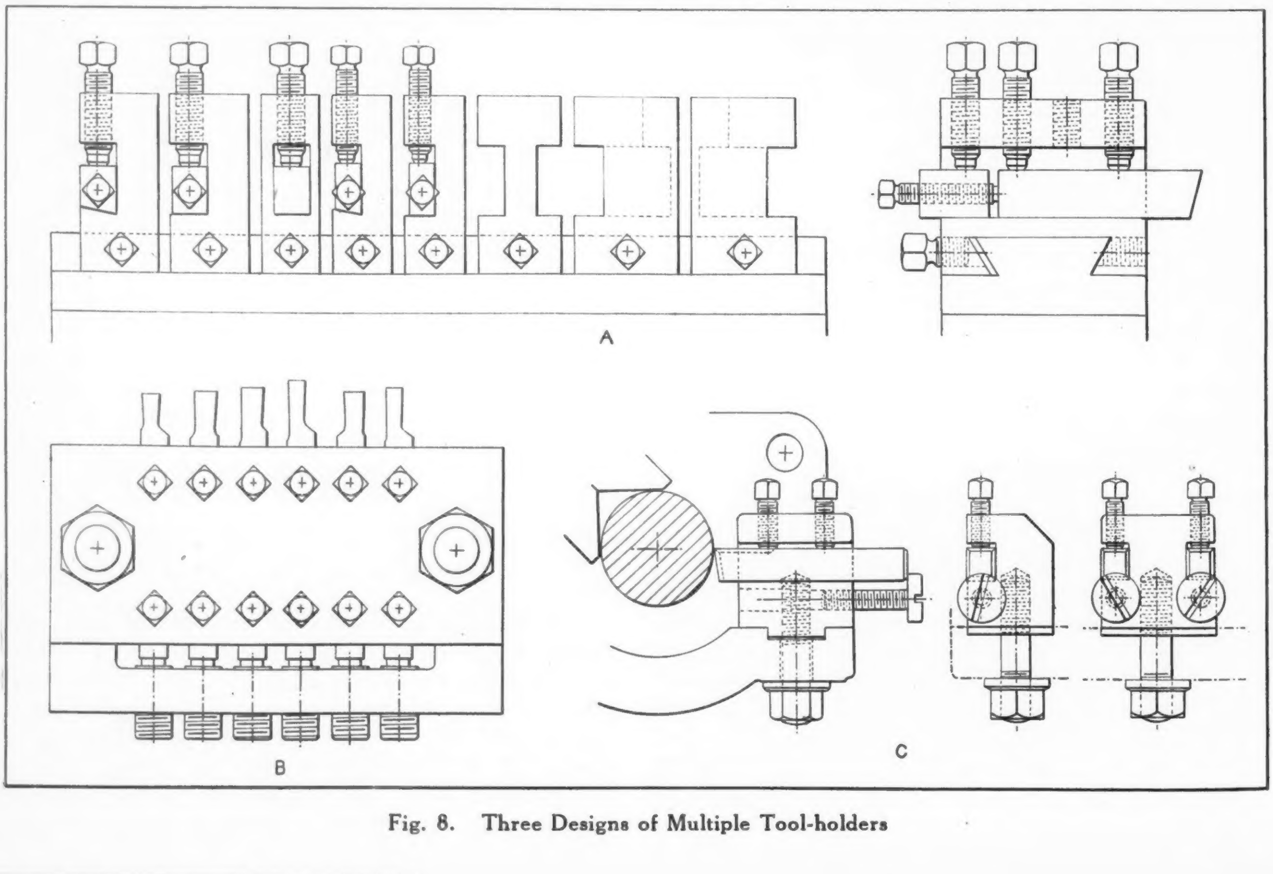


Fig. 8. Three Designs of Multiple Tool-holders

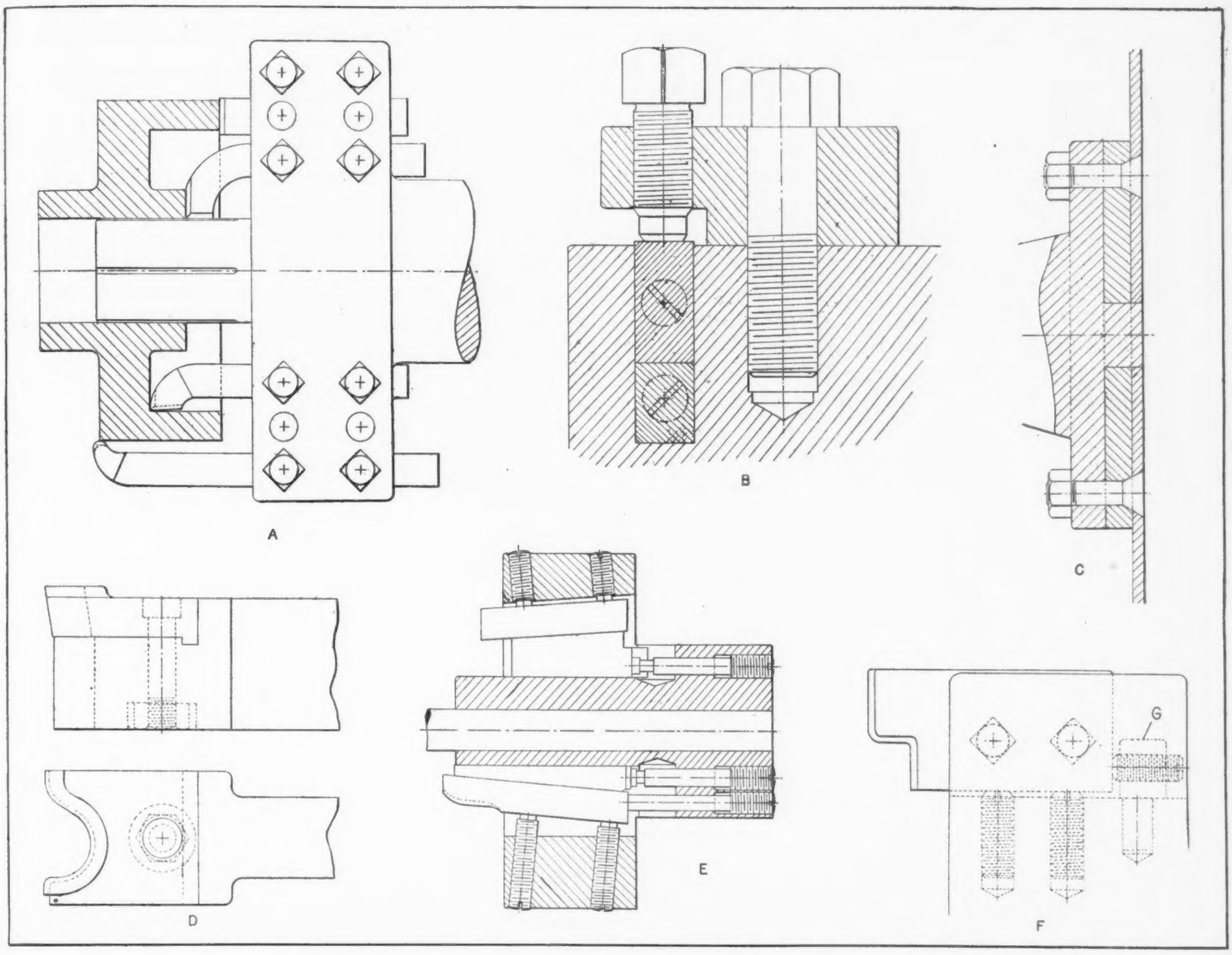


Fig. 9. Cutter-holders Designed to Meet Various Requirements

construction permits the position of the tool-blocks to be reversed, and also provides for lateral adjustment of the tools beyond the range of the regular toolpost. This design is used on the cross-slide equipment of a Warner & Swasey turret lathe.

Another type of tool-block which is attached by a dovetail and screws is shown at *G*, Fig. 7. This type of holder is employed on the "Lo-Swing" lathe. The key *H* may be placed either at the front or the back side of the dovetail tongue for the pur-

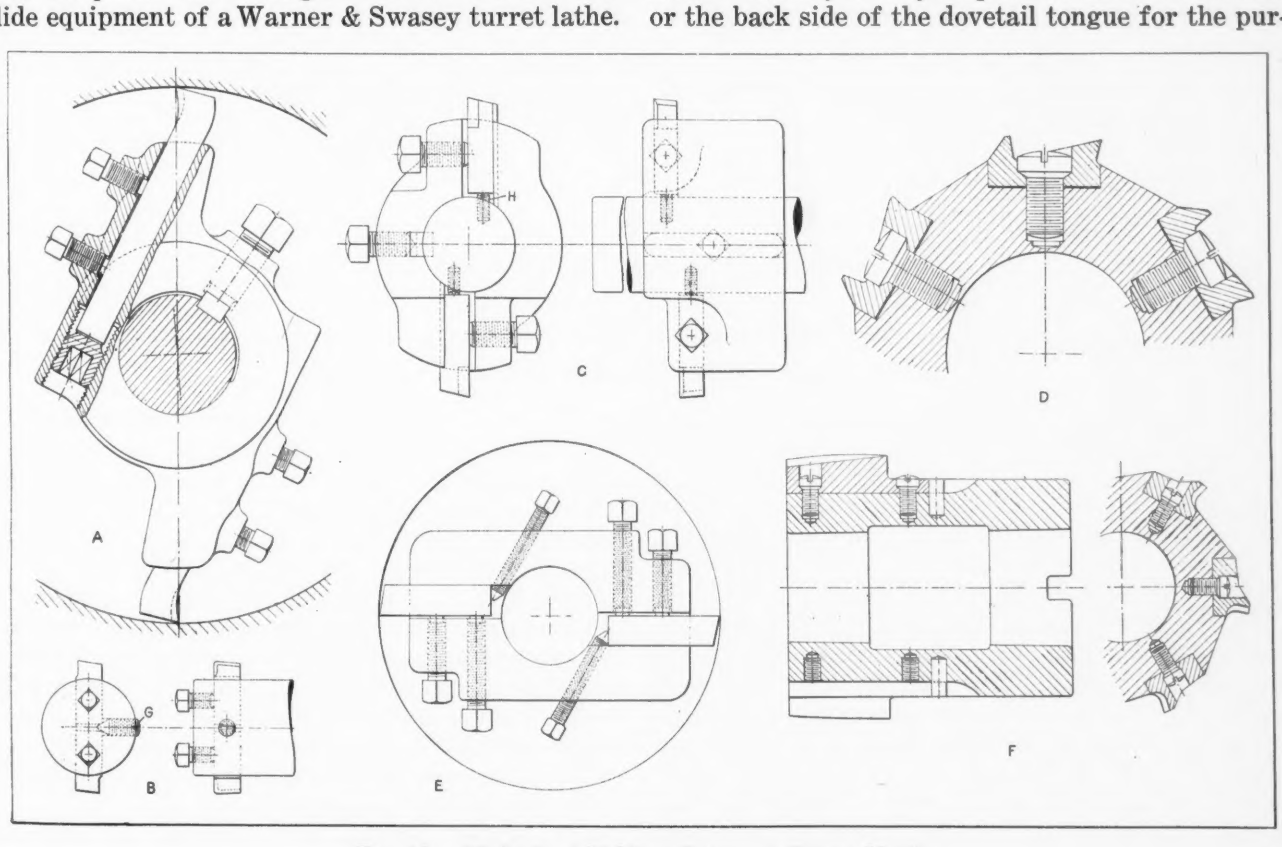


Fig. 10. Methods of Holding Cutters in Boring Heads

pose of locating the tool-block nearer or farther from the work, to accommodate the size of work to be turned. These blocks are built in both straight and offset types.

A convenient method of holding a number of tools in one block for work requiring a wide range of lateral and angular adjustments is to mount a heavy steel plate on two, three, or four pillars, and hold the tools in place by set-screws placed in suitably selected tapped holes in the plate. A holder of this type is shown at *B*, Fig. 8. A steel plate attached to the back of the holder and provided with a series of tapped holes receives the adjusting screws that back up the tools. When the tools are very narrow, as in the case of grooving tools, it may be necessary to stagger the tapped holes for the top and rear screws. Sometimes a block is cast solid to avoid the built-up construction shown at *B*, when the tool equipment is required for a long run of work. The plate for the thrust screws may also be included in the casting so that the completed block has much the same appearance as the built-up type.

The views at *A*, *B*, and *C*, Fig. 7, give some idea of the different tool settings obtainable in the turning and boring holder used on Warner & Swasey machines. Tie-screws *J*, as shown in the view at *C*, are used to prevent the sides from springing apart when the tool-binding screws are tightened. The tie-screws can be placed in any of the holes that do not happen to be used for clamping purposes. A multiple-tool turret head of similar construction, also made by the Warner & Swasey Co., is shown at *A*, Fig. 9.

Small blocks for box-tools, like the ones shown at *C*, Fig. 8, are commonly made with simple clamping screws and thrust screws for obtaining the required adjustment and taking the thrust of the tool. The chief difference in the blocks used for this class of work is found in the type of adjusting screw employed. The adjusting screw head is, in some cases, fitted into a notch in the tool. Sometimes the tool is provided with two notches to give a greater range of adjustment.

Screw Fastenings and Adjustments

Direct screw fastenings are seldom used for milling cutters, because the area of contact afforded by the end of the screw is not great enough to prevent vibration of the flat blades. In some cases, however, round cutters can be satisfactorily secured by screw fastenings. When this method is used, the round cutter must be a good fit in the reamed hole, and should be backed up by an adjusting screw, as shown at *C*, Fig. 6. The shape of the cutters may be clearly seen by reference to the top and side views at *D*. Large rotary planer heads are also equipped with clamping screws, generally two in number, which serve to bind the square shank tools in place. The clamping screws, in this case, pass through a forged steel ring, which is shrunk on the cutter-head.

For boring cutters, only one or two binding screws are required, even though flat cutter blades

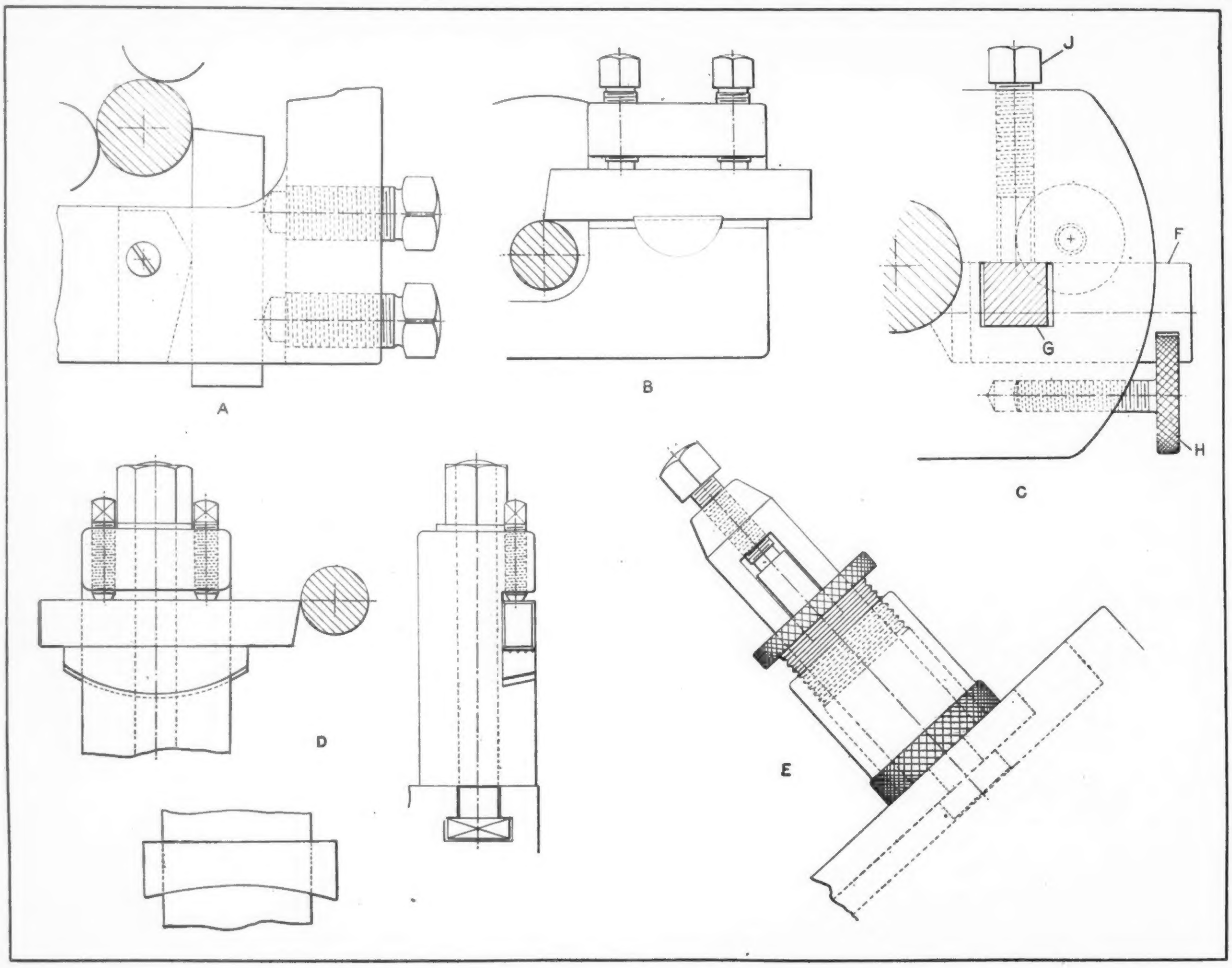


Fig. 11. Holders Provided with Means for Adjusting Tools

are used. The boring cutter is not subjected to intermittent cutting action, as is true with flat milling cutter blades, and does not require so rigid a fastening. The chief objection to the use of set-screws for holding the tool in smaller boring-bars is that the head projects too far, and often the length of the tapped hole permitted by the diameter of the bar is not sufficient to give the required clamping power and stand up under ordinary usage.

When the clamping screw can be located at the end of the bar, it generally proves more satisfactory. This method is commonly adopted for bars in which cutters are located near the end, which includes the type commonly used in turret lathes. In order to obtain greater clamping power or enable a limited amount of adjustment to be made, two cutters may be mounted on the end of the boring-bar, as shown at *B*, Fig. 10. In this case, a conical pointed screw *G* is used to adjust and back up the cutters, each of which is clamped in place by a set-screw at the end of the boring-bar.

On small boring heads, where the space is limited, the clamping screws can be located as shown in the view at *B*, Fig. 6. In this design, a key and screw arrangement is employed to secure the cutter-head to the bar. A large boring head in which each tool is fastened in place by two screws, and is adjusted by a headless set-screw, is shown at *A*, Fig. 10. This boring head is made by George Richards & Co., Ltd., of Manchester, England. The cutters are sloped backward to give a "trailing" cut. This construction has a tendency to eliminate vibration. It will be noticed that the hub makes contact with the bar on only one side, so that, although it can be readily removed or replaced on the bar, a better fit is obtained than would be possible with the ordinary full-bore contact and sliding fit.

At *C*, Fig. 10, is shown a boring head mounted on a bar in which set-screws *H* are provided for the purpose of adjusting and backing up the cutters. There is one objection to this construction, however, and that is that the blades must be removed in order to set the adjusting screws. For this reason, the design shown at *E* is preferable. The blades in the latter type of holder are flat, and are backed up by adjusting screws set at an angle in the holder.

At *F*, Fig. 9, is shown another type of holder with sunk adjusting screws and with a loose post *G* which holds the adjusting screw for backing up the cutter. The pin on the loose block is simply dropped into the hole in the holder, and the block is removed when longer cutters are employed.

Rather an unusual method of obtaining cutter adjustment is shown at *C*, Fig. 11. This view shows part of a boring head employed on a piloted turret bar in which two tools are mounted. These tools are required to be set very accurately for a face-grooving operation. In order to obtain the close adjustment required, a cylindrical plug *F* is provided for each tool. These plugs fit into holes drilled at right angles with the turret bar, and are slotted to receive the shanks of the grooving tools. The tool *G* can be adjusted toward or from the turret bar by means of the adjusting screw *H*. The slight clearance in the holder at each side of the tool is sufficient to permit the limited amount of adjustment required. An adjusting screw at the rear end of the holder provides means for feeding the tool forward. Two set-screws, one of which is shown at *J*, serve to clamp the tool in place.

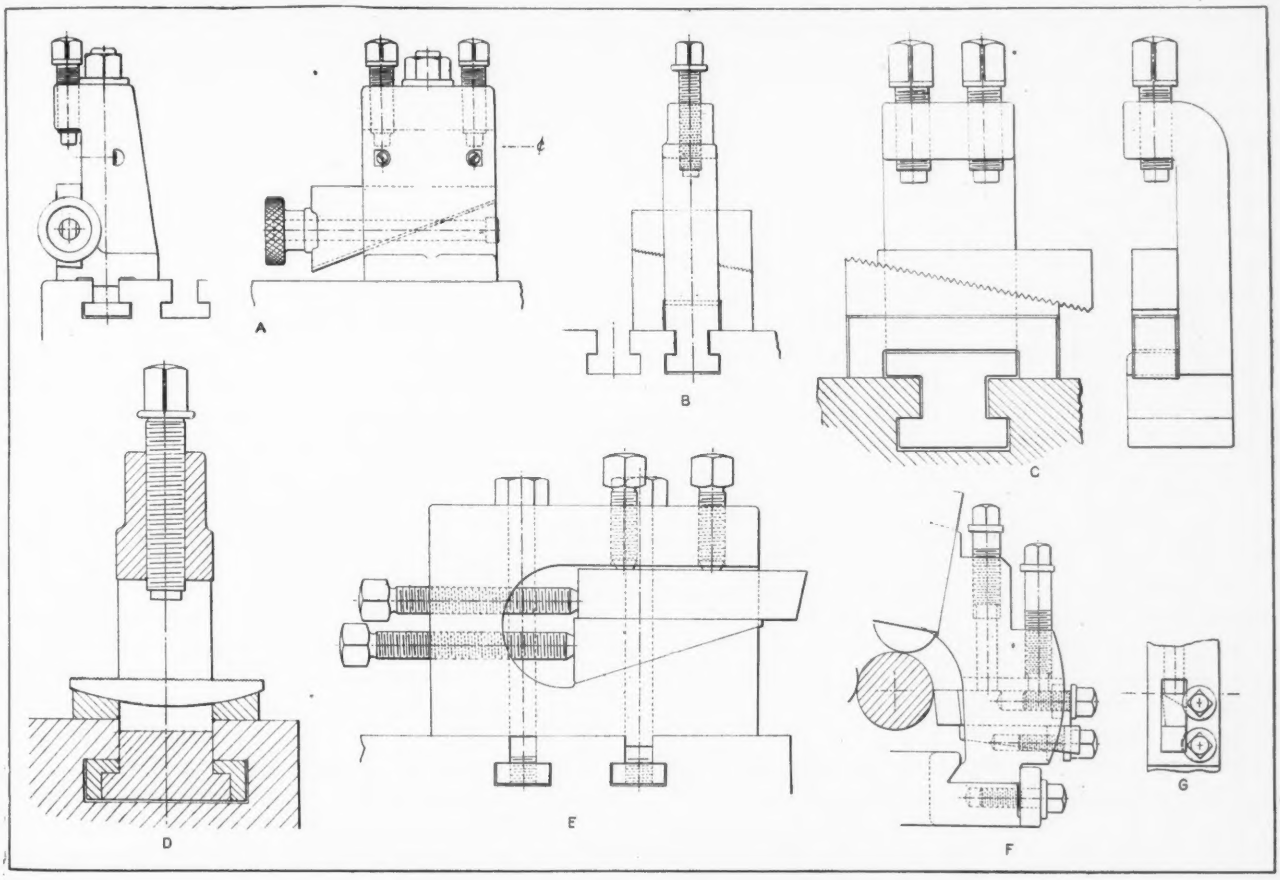


Fig. 12. Methods of Holding Turning Tools

At *B*, Fig. 13, is shown a method of holding a facing tool in a holder primarily intended for drills or boring-bars. A slot is machined in the holder to receive the cutter, and a hole is drilled and tapped at the end of the slot to receive a set-screw *D* for obtaining end-adjustment of the tool. A screw fitted in a saddle plate serves to clamp the facing tool securely to the holder.

Shim Adjustments

Before considering the numerous types of wedge and rocker adjustments for setting the tool point to the required height, it may be well to deal briefly with the method of obtaining adjustments of the tool by means of shims. This method, although somewhat limited in its applications, may often be used to advantage when very slight changes in the setting of a tool are required, as, for instance, in the case of a reamer. Thin shims of paper or foil are laid under the blades, and the tool is reground to the required diameter. This method is employed by the Gisholt Machine Co. in the construction of reamers like the ones shown at *D* and *F*, Fig. 10. In the case of the spiral single-tooth cutter blades shown in the view at *F*, no regrinding is necessary when only a small amount of packing is placed under the blades.

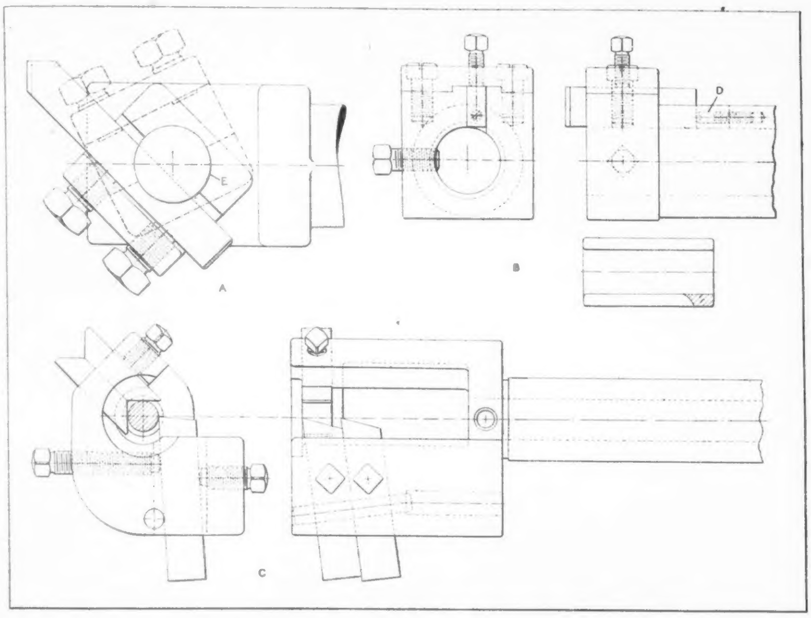


Fig. 13. Holders with Interesting Means for Adjusting Tools

In broad-blade tools, such as are used for taper turning or forming, a lip may be provided on the under side of the tool at the rear end, as shown in the view at *D*, Fig. 9. The combination of a lip and a through clamping bolt of this kind provides one of the firmest methods of holding a cutter. The same principle is used in holding the flush-side blades of cold saws in place, as shown at *C*.

Screw Fastenings and Wedge Adjustments

Many kinds of holders and toolposts are built with a wedge support for the tool. This construction provides a solid support and permits the tool to be accurately positioned. In some cases, the wedge block is serrated, but the more convenient method of obtaining adjustment is by employing an adjusting screw. In the case of cross-slide tools, serrations can be employed to advantage either in the closed type of post, such as shown at *B*, Fig. 12, or in the open-side type shown at *C*. The type illustrated at *B* is intended for use on the rear slide, while that shown at *C* is for use on the front slide, and is designed for a heavier class of work. An open-side holder of different shape, employed on Gridley machines, is shown at *E*. Here set-screws back up both the tool and adjusting wedge.

At *F* is shown a type of holder employed by the Brown & Sharpe Mfg. Co. In this holder, the tool is supported on a wedge that can be adjusted by means of a set-screw. Another set-screw is employed to back up and adjust the tool. In some of the blocks employed on multiple tool lathes, such as shown at *B*, Fig. 9, both the tool and the wedge are sunk into the metal, so that they are rigidly supported on all sides. The positions of the end-adjusting screws for the tool and also for the wedge are clearly shown. Tools for the more difficult operations of boring, facing, recessing, grooving, etc., can be readily adjusted by the wedge method. This type of fastening is shown applied to the head of a Hartness turret lathe set-up at *E*, Fig. 9. The upper tool cuts a shoulder and faces a flange on the work, and the lower tool smooths the curved interior of a differential case.

Notwithstanding the objection that the familiar rocking shoe alters the tool angle, its usefulness considerably outweighs its disadvantages. In the standard toolpost design, the shoe rests on a complete ring, as shown in the view at *D*, Fig. 12, but many of the narrow toolposts employed on turret lathe cross-slides are fitted with rocking shoes of the type shown at *D*, Fig. 11. In some cases, the curved surface on which the shoe rests is inverted, as shown in the lower view at *D*. A shoe constructed as shown at *B* may sometimes be employed for light work. The tool shown in this view is a Brown & Sharpe box-tool, and in this design, the diameter control can be held within very close limits by adjusting the pressure of the forward screw on the tool.

Other methods of obtaining the required adjustment by tilting the tool are shown at *A*, Fig. 11, and at *C*, Fig. 13. The first method consists of rocking the cutter on a beveled support, while in the second design, the adjustment is obtained by two screws bearing on opposite sides of the tool.

The rocker pin *E* of the holder shown at *A*, Fig. 13, serves a double purpose. First it acts as a pivot on which the tool clamp can be turned to various angles, or turned completely around for either turning or boring. Second, it acts as a pivot on which the tool can be swung to obtain accurate adjustment by means of the two binding screws.

Direct screw support and screw adjustment is not often employed, except as described in the first installment of this article. This principle, however, is used in the design of the holder shown at *E*, Fig. 11. This particular design of holder is employed on the rear chasing arm of a Fox lathe.

Letters on Practical Subjects

A UNIVERSAL JIG SYSTEM

A universal jig system devised by the writer, which is particularly adapted for use on gang drilling machines, is described in this article. The equipment consists of square and oblong cast-iron plates of various sizes, laid out with vertical and horizontal parallel lines spaced 1 1/2 inches apart and drilled and tapped at the intersecting points to receive 3/8-inch clamping screws. Hexagonal-head screws of different lengths, washers, cold-rolled steel blocks, and straps of various sizes with 25/64-inch holes, comprise the auxiliary equipment. A set of these jigs and their equipment has been in constant use for over five years, and has proved its efficiency and time-saving qualities on small-quantity production work requiring a fair degree of accuracy. The set is especially adapted for work that warrants only a small outlay for jigs.

The jigs described were intended primarily for use in drilling, but they have also proved very efficient on milling machine, shaper, and surface grinder work. A typical drilling job is shown in the accompanying illustrations. The split type, cast-iron eccentric strap *A*, Fig. 1, is required to be tap drilled, body drilled and counterbored on both faces of the screw bosses. Referring to Fig. 1, the strap *A* is set up on the 10-inch plate *B*, which has seven holes on a side. The cold-rolled steel straps *C* are bolted to the plate with their top ends on a line parallel with the bottom edge of the plate, and are so spaced that they support the eccentric strap by the ends of the bosses.

A block *X*, which is about 1/8 inch thicker than the eccentric strap, is placed against the right-hand boss, and serves as a stop for locating succeeding pieces of work. Clamp *D* is fastened on top of block *X*, so that the end containing the thumb-screw *E* overhangs one side of the eccentric strap. The straps *C* and block *X* serve to locate the work, which is clamped in place by the thumb-screw *E*. Two 25/64-inch holes, 1 1/2 inches apart, are drilled in the cold-rolled steel block *F*. Block *F* is bolted to plate *B* above the boss on the eccentric strap. A 1/4-inch hole is drilled and reamed in block *F* directly over the center of the eccentric boss. This reamed hole serves as a drill guide, and the block is hardened after being drilled and reamed. Strap *G* is bolted to plate *B*, simply to facilitate handling the jig, which is mounted on an angle-iron.

Referring to the illustration, the operations are as follows: First, the eccentric strap is placed in the fixture as shown in Fig. 1, and clamped in place by the thumb-screw *E*. Working from right to left, a 1/4-inch drill in spindle *H* drills through both bosses, the work being turned over in the jig to permit drilling the hole in the boss *J*. The hole in *F* that serves as a guide bushing is used only in drilling the 1/4-inch holes, all the following operations being performed with the boss to be drilled or counterbored located on the left-hand side of the fixture.

The next drilling operation, which is shown in Fig. 2, is performed with a 5/16-inch drill held in

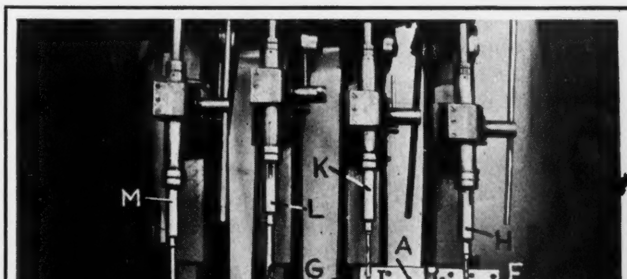


Fig. 1. Drilling 1/4-inch Hole Through Boss

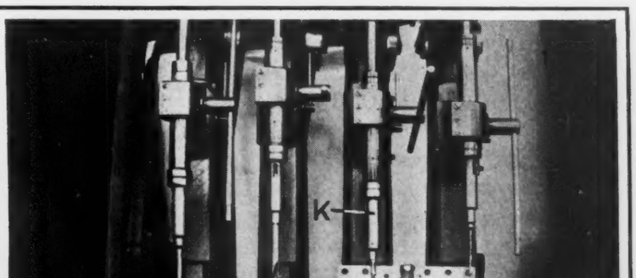


Fig. 2. Second Drilling Operation on Boss

spindle K, the boss supported by the clamp at the left-hand side of the jig being drilled first, after which the work is turned over in the jig and the boss at the opposite side drilled. In this operation, the bosses are only drilled half way through.

A 1/4- by 13/16-inch counterbore mounted in spindle L counterbores the under side of the boss, the work being located upside down, as indicated in Fig. 3. After counterboring one boss, the work is turned over in the jig and the other boss counterbored in the same manner. For the next operation the work is held in the position shown in Fig. 4. Here the spindle M is equipped with a 5/16-inch fillister-head counterbore, which counterbores the upper ends of the bosses.

The simplicity of the method developed for holding and locating the work will be apparent from an inspection of the four illustrations, which are arranged in the order in which the operations are performed. The stock of blocks, straps, bolts, etc., which have been made up, one at a time, as needed, now totals about twenty complete outfits, the range of which is sufficient to meet practically all requirements.

Walpole, Mass. JAMES A. KIRK

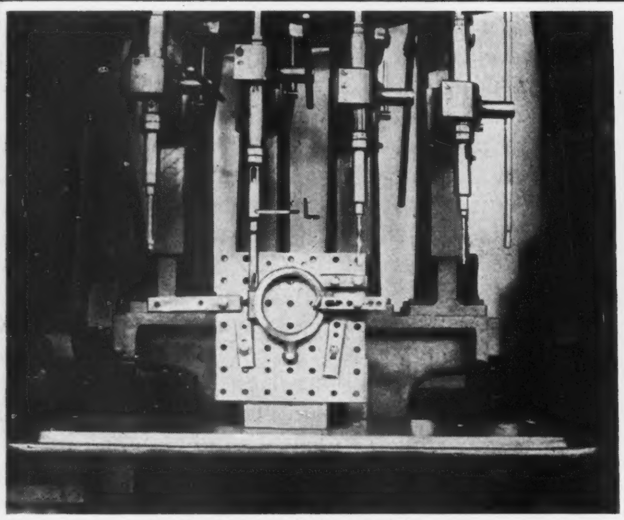


Fig. 3. Counterboring Lower End of Boss

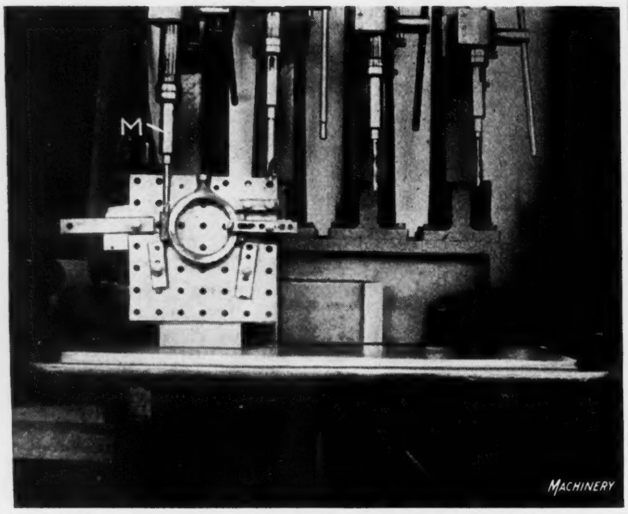


Fig. 4. Counterboring Upper End of Boss

USING AIR DRILL FOR POWER FEED

The time consumed, floor to floor, in facing four flanges on four sides of a casting has been cut from about 10 minutes to 1 1/2 minutes by operating the hand feed by means of an air drill. The machine, a plain miller, was equipped with an inserted-tooth cutter, mounted on the end of the spindle, the arbor supports and brace being removed. A turret type fixture, revolving in a horizontal plane and indexing around a point equidistant from all four faces, was clamped to the table. This set-up was very satisfactory, with the exception of the production time. As the table traveled a considerable distance and had to be reversed, indexed, and fed through four times by hand, the time required was considered excessive.

A highly satisfactory solution to this problem, that might be applicable to other jobs of a similar character, was the application of an air drive to the lead-screw. A suitable casting was made, and machined to provide a support for a stock air drill on the end of the table. This casting also housed the drive from the air drill to the lead-screw. This simple arrangement allows the operator to obtain the utmost from his machine, as he can, by a slight twist of the air drill control, vary the speed from a slow cutting speed ahead to full speed reverse, at the completion of the cut.

Syracuse, N. Y. E. P. STOUTENGER

TRIMMING BRASS TUBE ENDS

The article on page 133 of October MACHINERY, entitled "Trimming Ends of Brass Cups," brought to mind a scheme we use in our shop for trimming the ends of tapered brass tubes that form part of a radio loud speaker. The device is shown in the accompanying illustration.

An old hand-operated milling machine is used, and the tube-holding device is bolted to the table. The cutter A is a fine-toothed saw, placed on the spindle between two washers which are about 1/8 inch thick and about 1/4 inch smaller in diameter than the saw. These washers not only stiffen the thin saw, but also act as a sort of steadyrest to keep the brass tube B from chattering while being cut, since the tube rubs on the outer diameter of these washers during the operation.

The tapered brass tube, which has an elbow bent on the large end, is inserted into the fixture from the back or cutter side and is held in place by the double clamp shown in front. The clamp C that actually comes in contact with the tube is hinged at the left side and is made to fit the shape of the tube snugly. The outer clamp D is hinged at the right-hand side, and is locked over the inner clamp by means of a thumb-screw E in the usual way. When a tube is to be inserted, both these clamps are swung outward, to allow the tapered tube to be placed on a holding form to which it is clamped. The holding part of the fixture is so placed in the base casting that it may be turned completely around by hand. After the tube is in place, the milling machine table is run to the right, pressing the large end of the tube against the cutting saw until the washers on each side of the saw rub on it. The tube is then trimmed off by rotating the

Set-up Used in Trimming Brass Tube Ends

holding part of the fixture by hand. This trims the tube neatly, and leaves no fin on the outside nor on the inside, provided the cut is taken against the tooth travel.

Ordinary yellow soap rubbed on the saw acts as a "lubricant" and prevents the squealing that otherwise frequently occurs, especially when the saw is dull. A piece of the soap is shown at the right-hand end of the table and back of it is a trimmed tube, the cut-off end *F* of which is lying close to the base of the fixture.

Cleveland, Ohio — A. E. GRANVILLE

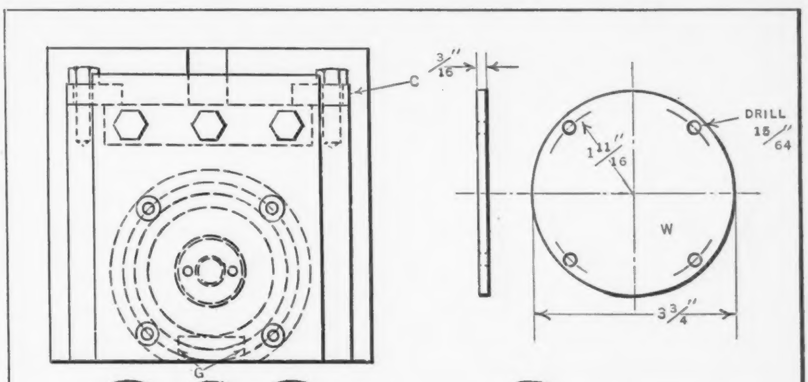
DRILL JIG FOR SMALL DISKS

The jig shown in the accompanying illustration is used in drilling four 15/64-inch holes in thin, gray iron disks like the one shown at *W*. The holes are close to the edge, and must be as nearly concentric as possible, as the edge of the disk must match up closely with the piece to which it is attached. The disks are not machined on the edges, but one face is finished. The disks vary in roundness and slightly in diameter, according to the influence of molding conditions.

The fixture is required to be reasonably rapid in operation, and must hold the work against the thrust of a multiple drill head while all four holes are being drilled simultaneously. It will be seen that the fixture consists of the casting *A* that forms the base, and a vertical guide on which the table-like carrier *B* slides. The gibs *C* serve to hold the carriage *B* in place. The carrier has a coarse-pitch thread elevating sleeve *D* that is rotated by means of the knurled rib around its center.

The stationary screw *E* is pressed into a hole in the base. The upper end of the knurled elevating sleeve *D* is prevented from coming out of the table by means of a ring nut screwed down against the shoulder of the sleeve. A fiber thrust washer is shown at *H*. Table *B* is recessed on its top face to a depth of about one-half the thickness of the disk. The edge of the recess is beveled, or given a 45-degree chamfer, in order to center the disk when it is forced against the under side of the bushing plate *F*. A notch *G* is cut into the edge of the table *B* to permit inserting the thumb and finger in order to obtain a good grip on the disks. Holes through the table under the drill bushings allow the chips to fall through. The machined side of the disks is presented to the drills.

Algona, Iowa — GEORGE WILSON



Jig for Drilling Four Holes in Small Disks

RECESSING TOOL FOR TURRET LATHE

The cutting of a deep recess some distance back from the end of a piece of work usually requires a tool of special form. If an ordinary slide tool is used, there is so much overhang that a great deal of chatter will result, thus giving an unsatisfactory job. The limited space in which special recessing tools are required to operate makes it very difficult to provide suitable means for removing the tool for sharpening and for making adjustments for depth of cut.

The work shown at *A* in the illustration is required to have a recess cut at *B* some distance from the end *C*. It will be noted that the recess is quite deep and of angular form. Were a long bar to be used in one of the regular turret-slide tools, in all probability there would be considerable chatter unless the tool were fed very slowly into the work. In order, therefore, to machine the work to good advantage, a support for the end of the bar is desirable. As the hole *D* is bored and reamed, it offers a good opportunity for a solid support.

The tool shown in the plan and longitudinal section views was designed for the work, and both

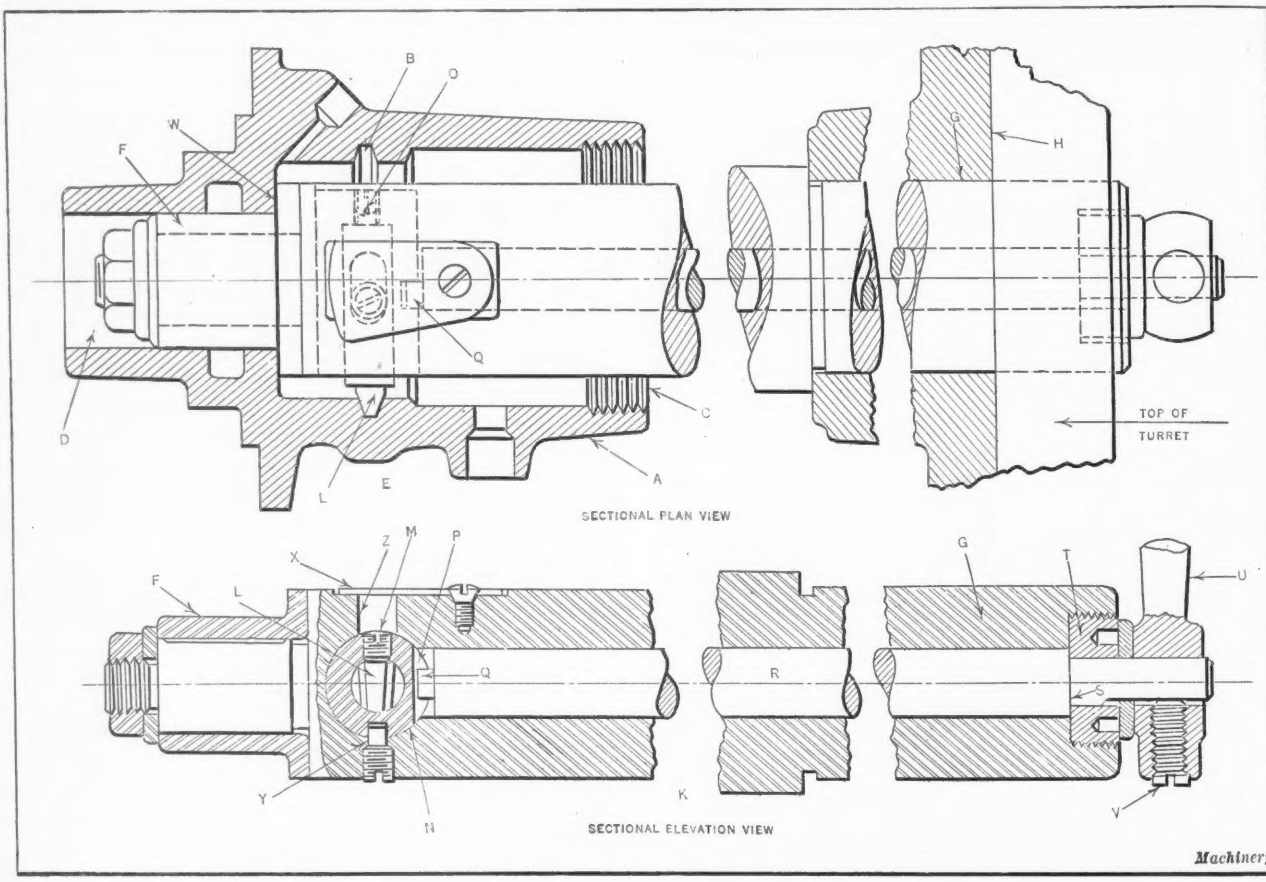
adjustment and upkeep were given due consideration in the design. The piloted end of the recessing bar enters the hole in the work, as shown. The bushing *F* revolves with the work, and therefore does not mar the surface of the reamed hole. The other end of the bar *G* is held in a regular toolholder bolted to the face of the turret *H*.

Referring to the sectional elevation view, it will be seen that the recessing tool *L* is made from round stock flatted on top, so that it can be held in place by a set-screw *M*. The holder *N* for the tool is also cylindrical in shape, and is made a good sliding fit in the cross-hole in bar *G*. The end of the holder has an adjusting screw at *O*, by means of which the tool can be readily adjusted. A slot is cut at *P* in holder *N* to receive the eccentrically located pin *Q* turned on the end of the operating rod *R*. Rod *R* passes completely through the shank or body *G* of the tool, and has a shoulder at *S* which is in contact with the bushing *T*, screwed into the end of the shank. At the extreme end of the operating rod is a lever *U*, which is secured in place by means of a set-screw *V*.

The particular tool shown was designed for use in a turret of the hollow hexagon type, and the lever *U* projects upward from inside the turret. A steel bracket (not shown) is bolted to the top face of the turret. This bracket contains adjustable stop-screws at each side, which serve to keep the movement of lever *U* within the required limits. In operating the tool, the workman, by moving lever *U*, causes rod *R* to revolve through a part of a revolution, and the eccentric pin *Q* in slot *P* moves the tool backward or forward as required.

The lower part of tool-holder *N* is splined and engages a flat dog point screw *Y*, which prevents it from turning. The bushing *F* on the end of the pilot acts as a stop against the face of the casting, thus fixing the position of the recess with respect to the shoulder at *W*. In order to give easy access to the tool *L* and make it possible to remove the tool for grinding, the bar is slotted at *Z*, so that a screwdriver can be used without difficulty. The spring steel swinging cover plate *X* prevents the chips and dirt from getting into the slot.

Detroit, Mich. ALBERT A. DOWD



Lever-operated Recessing Tool for Turret Lathe Job

HINGED SINE BAR WITH WORK-HOLDING CENTERS

The device shown in the accompanying illustration was designed by the writer for measuring or testing the taper on work such as plug gages and taper reamers. The main object in designing the device was to provide a means for measuring tapers that would be as accurate as the "sine bar and height gage" method commonly employed and yet avoid the so-called human element involved in the use of a regular sine bar. This was accomplished by making it possible to set the device for a given angle or to measure the angle of a taper by the use of standard gage-blocks. In the illustration, the device is shown set to test a gage having a taper of 1 1/2 inches per foot. The gage to be tested is shown in heavy dot-and-dash lines mounted between two heads on the tilting table.

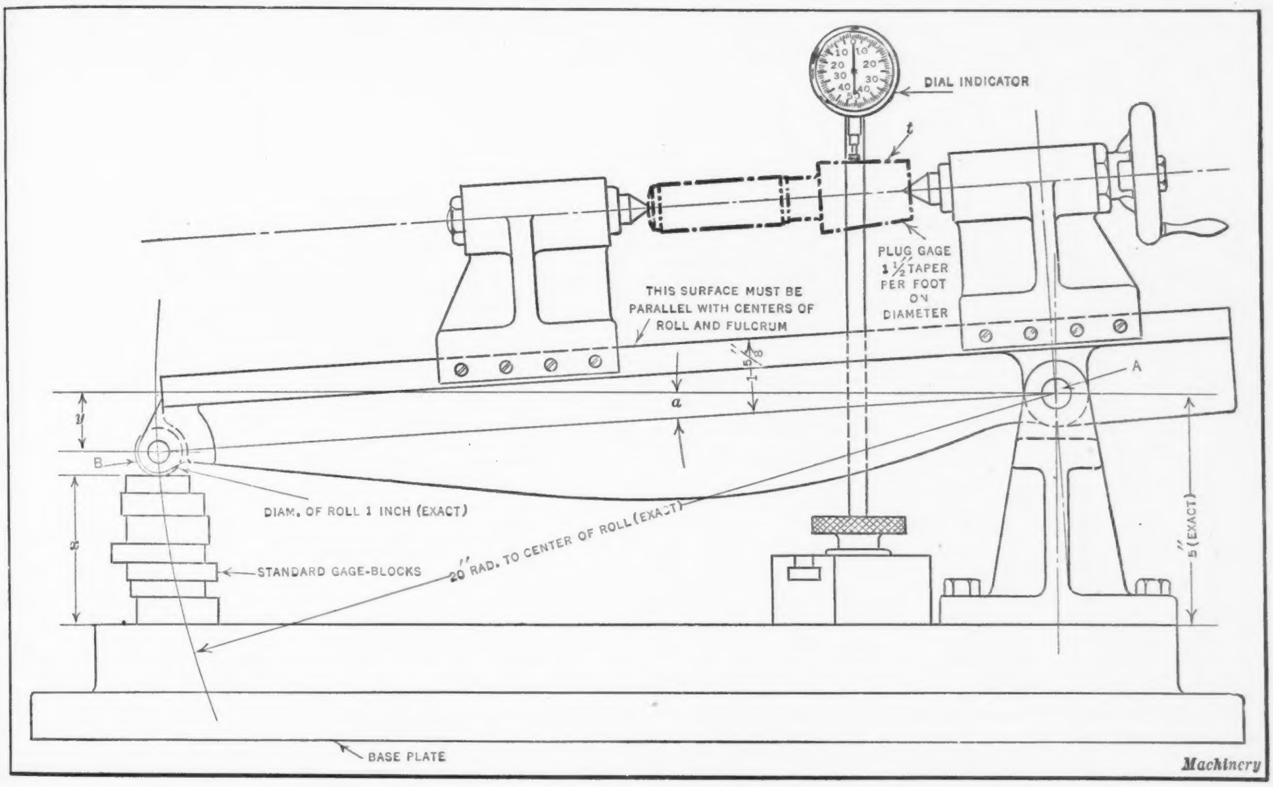
The principle of the testing device is similar to that of the sine bar. The center distance between the fulcrum pin *A* and the roll *B* is 20 inches. The distance from the center of the fulcrum pin *A* to the base of the fixture was made 5 inches for con-

venience in calculating the height x to be built up by gage-blocks in order to bring the top surface t parallel with the base of the fixture on which the stand of the dial indicator rests. After being set in the position shown, the dial indicator is moved from one end of the work to the other. If the taper is correct, the indicator needle will not deviate from the zero point; if it moves either side of the zero point, the taper is not correct.

In order to calculate the height x, we first find the angle a corresponding to the taper per foot required. This angle may be calculated by the following rule: Divide the taper in inches per foot by 24, and find the angle corresponding to the quotient in a table of tangents. Angle a, for the most commonly used tapers, can be found in the table on page 1030 of the sixth revised edition of MACHINERY'S HANDBOOK. After obtaining angle a, the height y is found by multiplying the sine of angle a by the distance from the center of pin A to the center of roll B. Next add one-half the diameter of roll B, or 0.500, to height y and subtract the sum thus obtained from the height of the center of pin A above the base of the fixture, in order to obtain the required dimension x.

Thus in the case of the gage shown in the accompanying illustration which has a taper of 1 1/2 inches per foot, we divide 1 1/2 by 24, obtaining 0.06250. From a table of trigonometrical functions we find the angle corresponding to tangent 0.06250. Having found this angle, which equals 3 degrees 34 minutes 35 seconds, we multiply the sine of this angle by 20, obtaining 1.2477, which is the height y. Adding 0.500 to the height y, we have 1.7477. Subtracting this result from the height of the center of pin A above the base, we obtain 3.2524 inches, which is the height x to be built up under the roll B with gage-blocks.

Buffalo, N. Y. — C. W. PUTNAM



Hinged Sine Bar with Work-holding Centers for Testing Tapers

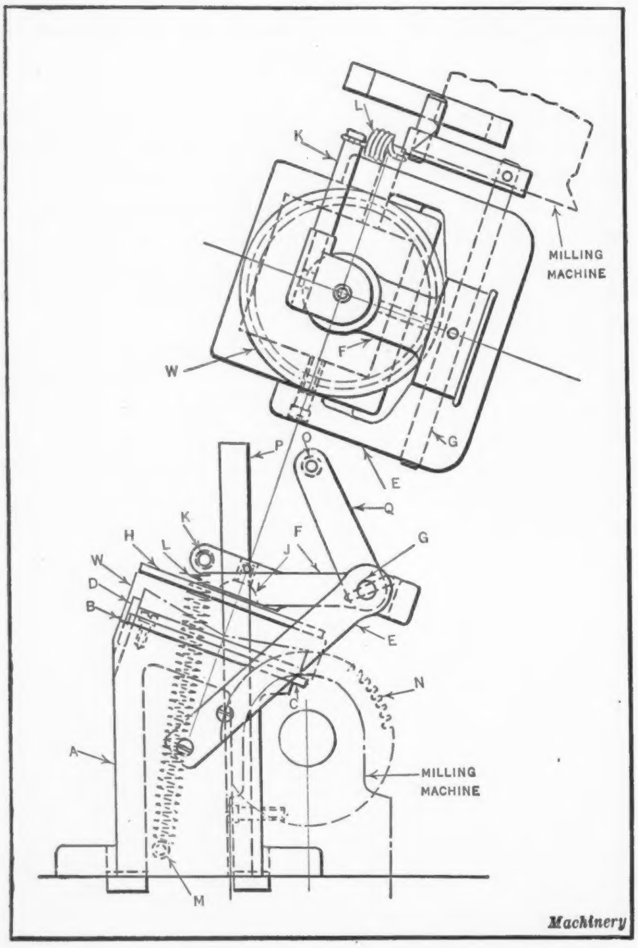
FIXTURE FOR MILLING SLOT IN BRASS CASTING

The fixture shown in the accompanying illustration is used on a hand milling machine for milling a 1/16-inch slot in a finished brass casting. The slot is milled at an angle of 20 degrees with the face of the casting. The fixture is so designed that the feeding movement of the milling machine table is utilized for clamping the work while the cut is being taken.

The base A of the fixture is clamped to the table of the hand milling machine. The top of the base at B is finished to an angle of 20 degrees, thus giving the required angle for the slot in the work W. On the angular face is fastened a ring plate C upon which the work is located, being positioned by pin D which fits a previously machined groove in the work. Yoke E is secured to the base by machine screws as shown, and carries the casting F, which is pinned to the shaft G. Shaft G, in turn, passes through yoke E. Casting F is connected to plate H by a ball socket pin at J. The clamping plate H is thus allowed suitable play, and is free to adjust itself upon the work W.

A spring pin K is driven into a hole in the casting F, as shown, and is connected by a powerful spring L with the pin M located in the base of the fixture. This construction causes plate H to be forced down on the work, clamping it against the locating plate C while the milling machine table is being fed toward the saw end.

To release the clamping pressure, the milling machine table is brought back, upon the completion of the cut, until the fixture is clear of the saw. At this point, the roller pin O strikes the steel strip P, which is fastened to the body of the milling machine. Pin O is a drive fit in lever Q, which, in turn, is pinned to shaft G. When lever Q is forced



Milling Fixture Equipped with Automatic Clamping Device

back by the action of strip *P* upon pin *O*, it causes shaft *G* to rotate which, in turn, rotates casting *F*, and consequently, the clamping plate *H*, thus releasing the latter member from contact with the work. After the operator has brought the table back far enough to permit the clamping plate to clear the work, the fixture can be unloaded.

The cycle of operations consists of loading the fixture; feeding the machine table in for the cut, which automatically releases the spring that exerts the clamping pressure on the work; bringing the table back to clear the cutter, which automatically unclamps the work; and unloading the fixture. It is the writer's opinion that this type of fixture can be used to advantage on many hand milling jobs where a light cut is taken.

New York City — B. J. STERN

MAKING TWO DIFFERENT SCREW MACHINE PRODUCTS SIMULTANEOUSLY

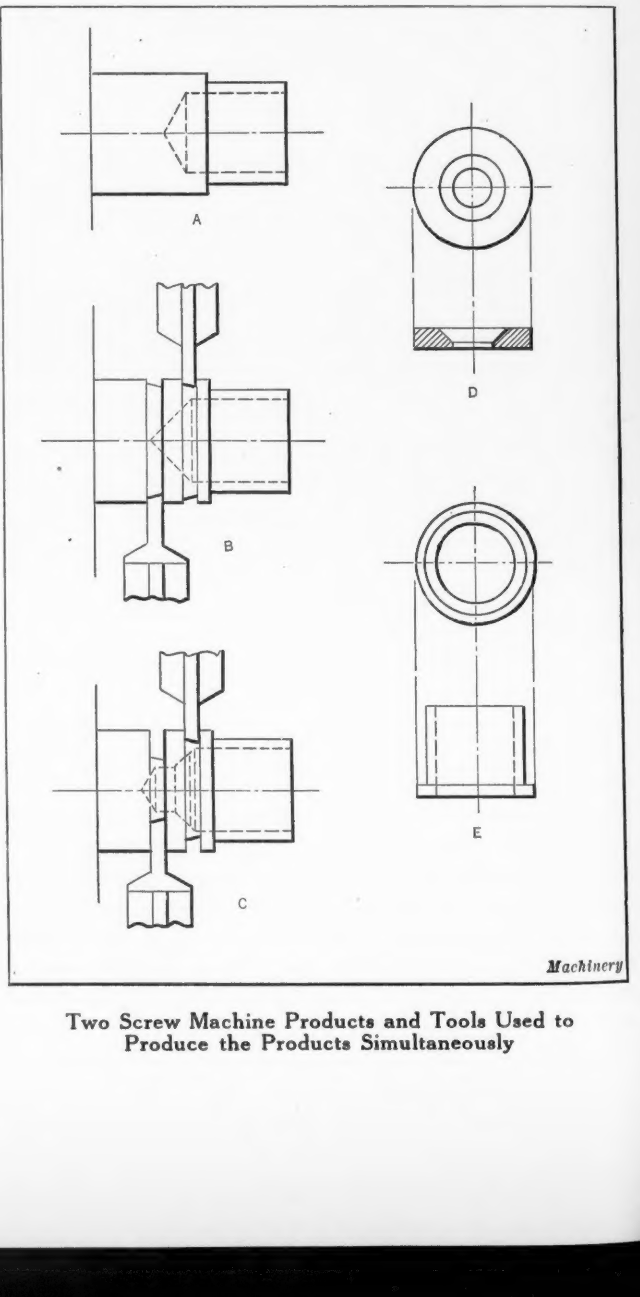
In the accompanying illustration is indicated how two wholly different screw machine products were made with the same set-up. One of the articles *E*, as will be noted, is a flanged sleeve, while the other shown at *D* is a washer with a 90-degree countersunk hole, both parts being made from steel. The outside diameter of the sleeve was to be held to fine limits and have a good finish. This, and the internal shape of the washer, rendered it impossible to find, among the large number of finished cams on hand, a set that would make either article economically. At the same time, the number of parts required, while relatively large for a hand machine, was so small as to make the items of two set-ups and two sets of cams loom up large in the cost figures.

By combining the two jobs so that one set of cams could be used, the parts were handled simultaneously and to advantage on a No. 2 B. & S. automatic. There were no complications, either as to set-up or production to offset any part of the advantage gained in the saving of the price of a set of cams and one set-up. The sequence of operations is shown in views *A*, *B*, and *C*. First, the stock is fed out to the stop, the machine indexed, the work centered, and the machine again indexed. Next, the work is drilled and rough-turned and the machine indexed. The work is then finish-turned and the machine indexed. An 82-degree point drill is then brought into operation and the cut-off started. The machine is indexed, after which the 1/4-inch drill is brought into operation and the cut-off finished. In addition to the saving on setting up and cams, inspection on the machine was reduced over what it would have been for two different jobs.

Santa Ana, Cal. — HENRY SIMON

* * *

Imports into Italy under the general head of "machinery, apparatus, and their parts" totalled 69,000 tons during the first six months of 1926, valued at $24,500,000. This is an increase of nearly 32 per cent in tonnage and 25 per cent in value compared with the same period in 1925.



Two Screw Machine Products and Tools Used to Produce the Products Simultaneously

Chromium Plating*

By W. N. PHILLIPS, General Motors Corporation

THE application of chromium plating has two main purposes: On some classes of work, this process is employed to produce a permanent decorative effect, and on others, to prolong the life of mechanical parts that are subjected to unusual conditions, either as to wear or temperature. Chromium plating has been used for decorative effect by the General Motors Corporation for considerably over a year on Oldsmobile radiators and bumper bars. Its use is now being extended to other cars manufactured by this corporation.

Method Employed and Its Advantages

The method followed is first to produce as smooth a surface as possible, and then apply a light coating of chromium. In order to produce this smooth surface, the practice is to copper- and nickel-plate the steel parts; then, after the articles have been buffed to a high finish, a light coating of chromium is applied, which comes out in lustrous form.

This method has several advantages. The first is the comparatively low cost, considering the protection obtained. We have found that it is somewhat difficult to produce nickel-plating under 0.001 inch thick that will withstand a salt spray test of fifteen hours. However, a steel base, nickel-plated with this amount of nickel, and then chromium-plated, will withstand a salt spray test of eighty to one hundred hours.

Aside from protection against rust, the chromium surface is infinitely superior to the nickel surface, even if a pure nickel sheet were used, inasmuch as the chromium will not tarnish under ordinary conditions of exposure, such as exposure to salt air and high humidity, like that encountered in Florida and southern Texas.

The cost of chromium plating is not excessive if it is done in accordance with the outline previously given. Although chromium plating is a much patented process, the companies owning these patents are willing to license their processes. The chief material used for chromium plating is chromium trioxide, which contains about 50 per cent of chromium metal.

The cost of chromium trioxide is about 35 cents per pound, and the price probably will be lower as the use increases. The reason for the probability of a price reduction is that, until chromium plating started to come into general use, no great volume of chromium trioxide was used; consequently, it was made in small batches, and shipped around in glass bottles. There is now an Interstate ruling, permitting shipment of chromium trioxide in non-returnable steel drums, similar to those used to ship caustic soda.

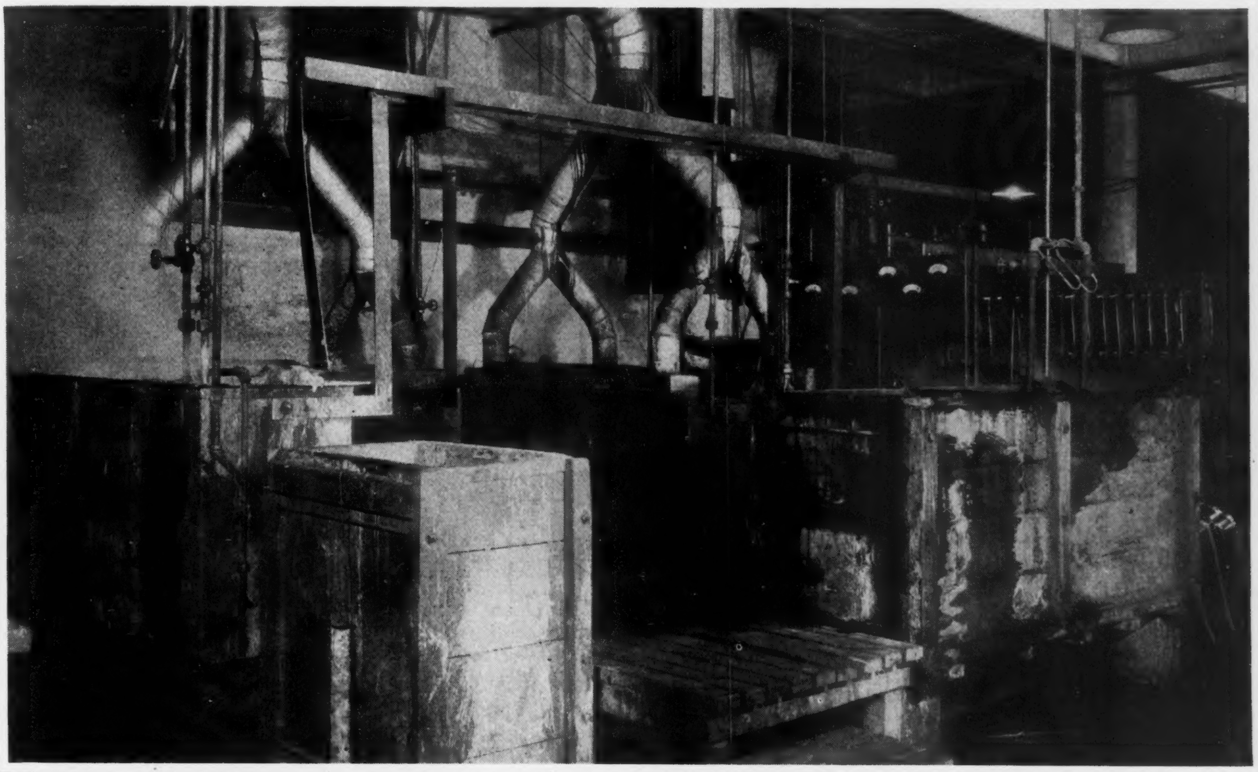


Fig. 1. Chromium Plating Equipment Used to Apply Light Coating of Chromium after Radiator Shells have been Nickel-plated and Buffed

*Abstract of a paper presented at the annual meeting of the Society of Automotive Engineers, Inc., Detroit, Mich.

Chromium Plating for Decorative Effect and Protection

In applying chromium to articles such as radiator shells and bumper bars, high current densities are used, and very short immersions in the plating baths. Fig. 1 shows the chromium plating equipment used after the shells have been buffed. This equipment has been successfully employed in chromium-plating many thousand pieces. The hardness of chromium is a controllable factor. Chromium can be deposited and quite readily buffed, but it is our belief that the greatest luster can be obtained by depositing the chromium in its bright modification.

In a paper on this subject previously presented before the Society of Automotive Engineers by Dr. Fink, the difficulty of wetting the surface of chromium was given as one of the reasons for its high protective value. This appears to be an important feature; however, we do not believe that chromium, by itself, is as good a rust preventive coating for steel and iron as a combination of chromium with other metals, the chromium, of course, being the top layer. It is very difficult, indeed, to plate other metals over chromium, unless certain precautions are taken, but the value of such procedure is not particularly great in the decorative field.

When light coatings of chromium are applied over nickel, or copper and nickel, as previously described, the resulting coat, while extremely hard, will not withstand a file test. However, it will withstand ordinary usage on car parts for long periods of time. We cannot say definitely how long, because of the fact that our cars have not yet been out a sufficient length of time to wear out the chromium. Regular production was started at the Olds Motor Works in September, 1925, and many cars produced, experimentally, more than a year before that, are still in splendid condition.

Mechanical Application of Chromium

Another application of chromium, which may, in time, become important to the automotive industry, and to other industries as well, is the mechanical application. On plug gages, thread gages, and certain other gaging tools, the use of chromium has been very successful. In this particular instance, the gages are ground about 0.0005 of an inch under size; they are then brought up to size with chromium, by plating them with an excess of chromium, which is later ground to size, or the gages may be plated exactly to size. When the gage has finally worn out, the plating is removed, and a new coating of chromium applied. It is thus possible to use the same gage for an indefinite period. It is in this work that the control of hardness is of particular importance. We have been able to produce gages with one plating that would last from two to twenty-five times longer than the best steel gages. Fig. 2 shows the smaller equipment used for chromium plating tools and gages, and Fig. 3 shows the method of suspending tools and gages for plating. The racking and wiring is similar to that used in any kind of electroplating. Chromium plating is really not a difficult process.

Owing to the low coefficient of friction between chromium and other metals, we have been able to apply chromium to burnishing tools with a great deal of success. It has been suggested, along this line, that chromium be applied to dies for drawing, particularly on non-ferrous metals. Files used for cutting soft metals can be chromium-plated to great advantage, inasmuch as the metal does not clog up the file, as it does on untreated files.

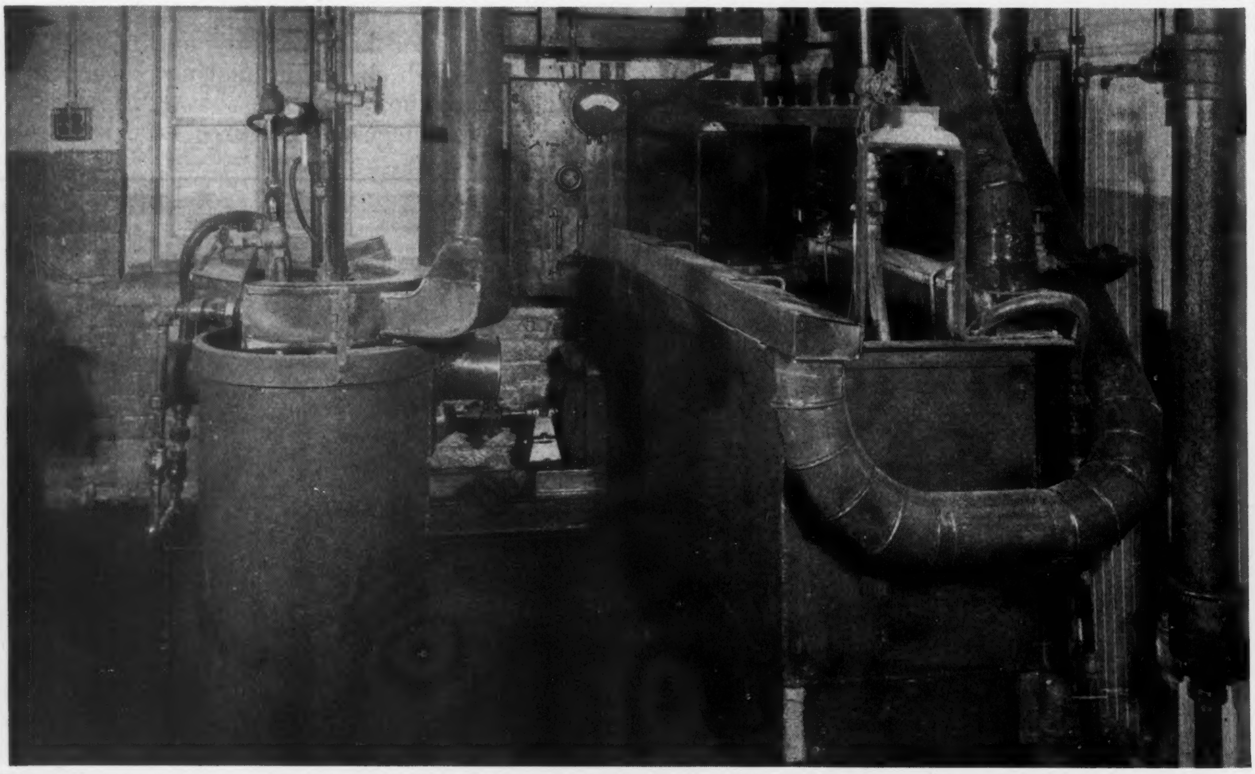


Fig. 2. Smaller Equipment Used in Chromium-plating Tools and Gages

Hardness of Chromium

How hard is chromium? This question has often been asked. We do not know exactly, because we have not yet developed an instrument for measuring its hardness. By the use of microcharacter, we have been able to measure some of the softer deposits of chromium plate, and have found that they are considerably harder than our hardest steels.

Glass cutters made from copper have been used to illustrate the hardness of chromium. They are simply made from 1/4-inch round copper wire, which has been filed down to an edge, and then chromium-plated with about 0.005 inch of chromium. These cutters do a very creditable job.

It is necessary to back up chromium plating with hard metal, if the article plated is to be put to hard

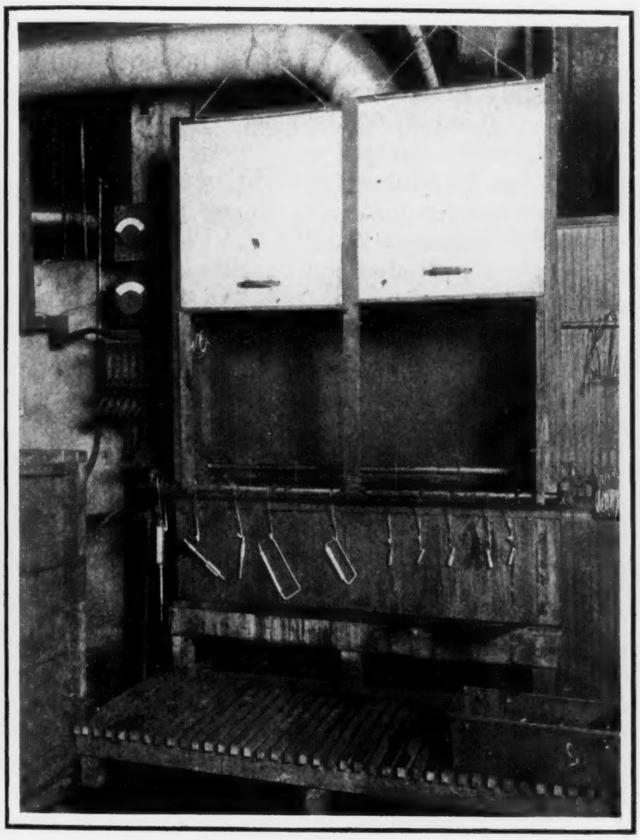


Fig. 3. Method of Suspending Tools and Gages for Chromium Plating

usage. In other words, if the impact is great, the steel parts should be carburized, or, at least, cyanided, before chromium is applied. We do not recommend chromium for edged tools used for cutting hard materials, inasmuch as there is a tendency to fracture the chromium and cause the work to be roughened.

To what extent chromium is to be applied to the bearing surfaces of an automobile has not been determined. About one million small spindles were chromium-plated instead of being carburized or hardened by other means. These spindles carry a very low load per square inch, but are subject to extreme wear conditions. We have found that the chromium, in this instance, stands up better than the parts did when they were carburized. Chromium-plated piston-pins are now in production, in a small way, with the expectation that this use will be considerably extended.

NEW INDUSTRIAL MOTION PICTURE

At the monthly meeting of the Boston branch of the National Metal Trades Association on January 5, the Norton Co., Worcester, Mass., showed for the first time a new industrial motion picture film entitled "The Age of Speed." The purpose of the film is to educate the general public on the subject of grinding, and many thrilling scenes emphasize the fact that we are truly living in a high-speed age. Such scenes as airplane stunts, the Twentieth Century speeding its way westward, automobile track races, and motor boat races, point out that our modern life differs from that of our forefathers chiefly in the rate of motion. Comparison is made between old and modern production methods in many industries, such as the textile, agricultural, woodworking, and paper and pulp industries. It touches on many subjects, ranging from the rolling of cigarettes to a remarkable demonstration of a fleet of battleships in action.

A considerable part of the film is devoted to the manufacture of automobiles, trucks, and tractors, featuring many operations that will interest mechanics, as well as the general public, in the great automobile plants. Some of the more interesting views are scenes in the grinding departments, where camshafts, crankshafts, and other parts are being finished, stressing the importance of accurate grinding and its influence in the assembling and consequent durability of the motor.

All through the film it is prominently brought out that grinding plays a great part in modern accuracy of manufacture, rapid production, and high speed. Only a small part of the film is devoted to the manufacture of grinding wheels and machines, but the scenes in the electric furnace plants and their surroundings, which include views of Niagara Falls and the hydro-electric plants, are full of interest.

The film presented by the Norton Co., though highly educational in character, is of sufficient interest to entertain any motion picture audience.

* * *

SECOND ANNUAL WELDING CONFERENCE

More than two hundred industrial men attended the second annual conference on welding under the auspices of the Engineering Extension Department of Purdue University, recently held at LaFayette, Ind. At this conference there were demonstrations of electric, thermit, and oxy-acetylene welding, and a number of papers were read by welding engineers from various parts of the country. In one of the addresses by A. G. Bissell, welding engineer of the Westinghouse Electric & Mfg. Co., devoted chiefly to the welding of structural steel work in buildings, the speaker stated that it has been proved by tests that arc-welded joints in structural steel will stand severe vibration and shocks, answering the argument advanced by popular opinion prior to this time. Results show that the three electric arc-welded buildings built by the Westinghouse Electric & Mfg. Co. have been built at an average saving of 11 1/2 per cent over the architect's estimates for riveted steel construction. It is probable that in the future even greater savings will become possible.

The Machine-building Industries

THERE was a slight decrease in manufacturing activity during the last two months of the past year, but the production of important minerals continued at such a high level that the Federal Reserve Board's index of production in basic industries still showed an advance. Pig iron production decreased slightly, and steel mill operations were considerably reduced. Automobile production, which is not included in the Federal Reserve Board's index of production in basic industries, declined sharply (as is well known) in November and December, but another of the basic fields—the building construction business—showed less than the usual seasonal decline, and was slightly larger both in November and December, 1926, than for the corresponding months in 1925.

The building industry has been one of the main factors responsible for the high peak in industrial activity during the past year. According to the *Architectural Forum*, the closing figures for 1926 show the astounding total of well over $6,000,000,000 invested in new building construction during the year. Including alterations and unrecorded transactions, this total is doubtless over $7,000,000,000, thus establishing for the past year an unprecedented record of activity, and one that probably will be unequalled for many years to come.

While no one expects that 1927 will record as great a national building investment as 1926, all indications point to the fact that the present year will doubtless be one of the great years in building history, with a total investment in new building construction of about $6,000,000,000 as compared with the $7,000,000,000 record of 1926. The influence that this will have on the machine-building and metal-working industries in general will be very pronounced, because the building field reacts through a great many channels upon the machine-building field.

Machine Tool Orders Decrease Slightly

In the machine tool field, there has been a decrease in new business from the high peak reached last year. According to a statement by Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, the machine tool orders during December showed a decline from the two preceding months. It is stated, however, that the index figure for machine tool orders is still well above the low point of the past year. Based upon a comparison of indexes for the last two years, 1926 was a 10 per cent better year in the machine tool industry as a whole than 1925.

It is also pointed out that the industry has a good chance to sell more machines by stronger selling efforts directed toward shops whose equipment is relatively old. The increased productivity of modern types of machine tools is ample justification for the purchase of these new machines in thousands of cases. It is true that some factories are over-equipped—in the sense that there are still some machines standing idle—but they are not over-equipped with machines that are profitable to use; they are over-equipped only with obsolete unprofitable machines that should not only be idle, but scrapped.

Exports of Industrial Machinery Increase

The exports of industrial machinery for November, 1926, the last month for which complete statistics are available, amounted to $14,796,000. This was an increase of 19 per cent over the corresponding month of 1925, and 27 per cent over October, 1926. The total volume for the first eleven months of 1926 was $143,000,000, and approximately $156,000,000 for the entire last year, a gain of about $7,000,000 over 1925.

In the metal-working machinery field, the total exports for November, 1926, amounted to $1,667,000, and the total for the eleven months ending November 30 was $17,389,000. While there was an increase in industrial machinery exports, in general, there was a decrease in the exports of metal-working machinery, which reached a total of $20,000,000 for the first eleven months in 1925.

The Iron and Steel Industry is Slowly Improving

The production of pig iron and steel in December was the lowest for any month in 1926, although production was by no means at an unusually low level. The pig iron output was, according to the Iron and Steel Institute, 3,091,060 tons, and the steel output, 3,472,000 tons. Thirteen blast furnaces were blown out and four were blown in during the month. Prices show no indication of any appreciable change. An improvement is noted during the last few weeks, especially in increased demand for pig iron. The United States Steel Corporation is operating at a somewhat better rate than its December average of 83 per cent of capacity, and the independent companies, which operated as low as 60 per cent in December, have increased production to from 65 to 70 per cent.

Automotive Industry Increases Production

The automobile industry reached a low level of production in November and December, but a gradual increase has taken place during January. An attitude of caution, however, still dominates the production schedules of most of the automobile companies, and none of them seem anxious to add further to their dealers' supplies of cars. The results from the New York automobile show are reported to have been satisfactory, and material increases in production are reported from numerous plants, including those of Ford and Dodge.

It is estimated that 21,600,000 cars and trucks are now registered in the United States, of which close to 19,000,000 are passenger cars. This is an increase in registration of approximately 1,750,000 cars over a year. Considering the production in 1926, this would indicate that during the past year over 2,200,000 cars were scrapped.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

"HYPRO" PLANER-TYPE MILLING MACHINE

The latest development of the Cincinnati Planer Co., Cincinnati, Ohio, is a "Hypro" planer-type milling machine which was designed to meet the requirements of a customer. This machine is equipped with two rail and two side milling heads, all of which are independent of each other. It is possible to rapidly traverse one or all of the heads at the same time and to feed one or more heads while the others are being rapidly traversed. Also, the quill of one or more heads may be fed while the quills of the other heads are being moved by the rapid traverse. The vertical adjustment of the quills is 6 inches. All of these head movements can be controlled from either the right- or the left-hand side of the machine through the operation of two levers. The table is moved independently of the heads. An automatic safety friction prevents accidents in the event that the two rail-heads are jammed together, a side-head run against the rail, or a cutter jammed into the work.

Two independent speeds are provided for all heads through a gear-box. There are two 15-horsepower motors on top of the machine, one of which drives the spindle of the two rail-heads, while the other supplies power to the two side-heads. These heads are designed to transmit 50 horsepower. There is a narrow guide on the rail, which prevents twisting of the heads and assists in feeding them across the rail.

The rail is clamped securely enough to take any cut, by a single turn of a clamping device. In loosening the rail, a clutch is engaged which delivers power to the elevating device. This clutch is disengaged as the rail is clamped, and so it is impossible to elevate the rail when it is partially or totally clamped. For loosening and raising the rail, the same lever is manipulated as that which controls the direction of the rapid traverse to the heads. When the rail is high above the table, the rapid traverse lever of the side-heads can be employed. This arrangement provides four levers which may be operated for raising or lowering the rail. One motor supplies power for moving the rail and for rapidly traversing the heads.

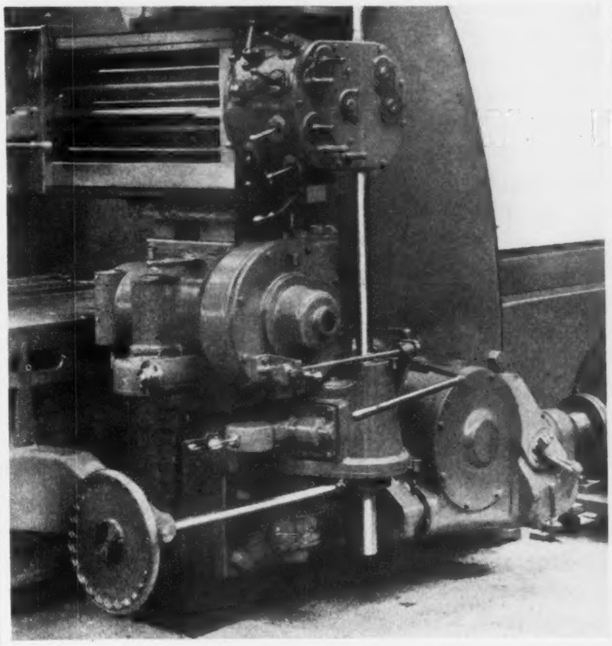


Fig. 2. View Showing the Centralization of Controls

Fig. 1. "Hypro" Planer-type Milling Machine

All three motors are controlled from one board which has dials that give the motor speeds. A three-push-button switch is supplied for each motor, and these switches are so interlocked that it is impossible to feed the table in either direction unless the spindles are revolving. If either of the driving motors should fail, the table motor will stop automatically. Push-button switches are placed on both sides of the table, and a start and stop button on the control lever. The entire machine is controlled from the normal position of the operator.

Force-feed lubrication is supplied to the ways of the bed and table by a pump which is driven by the motor that actuates the table. This method insures lubrication under all conditions. The bed is made twice as long as the table, so as to eliminate overhang. A clamp and inner guide prevent the table from lifting

in operation. The drive to the table is first through worm-gearing and then through herringbone gears in the bed up to the bull gear and rack. The latter are of a special design so that three teeth of the bull gear are always in mesh with the rack teeth.

The complete train of gears is flooded with oil, and the shafts that carry these gears revolve in bearings lubricated by the forced-feed system that oils the ways. There are fifteen motor speeds, and with a back-gear, thirty table speeds are obtainable. The range of cutting speeds is from 2 to 16 inches per minute, there being also a high-speed return of 25 feet per minute.

The control lever used to change from cutting to high speed and into neutral is placed in a convenient position for the operator. There is also a hand adjustment, by means of which it is possible to move the table 0.001 inch with ease. This hand device can be disconnected through a clutch, so that the handwheel does not revolve when the table is operated at high speed. A graduated scale on one side of the table permits direct readings of table movements to be taken. Ball and roller bearings are furnished throughout the machine.

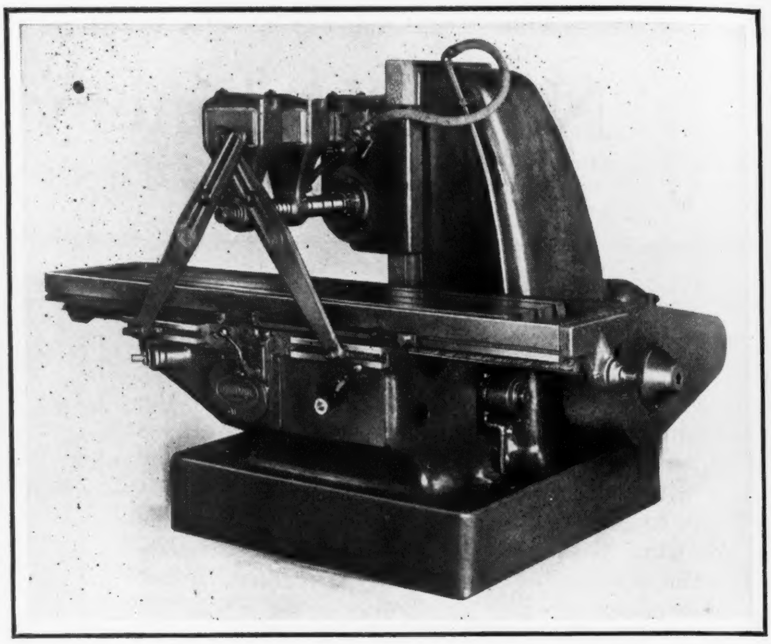


Fig. 2. View Taken from Front of "Rigidmil"

SUNDSTRAND "RIGIDMIL"

The Sundstrand Machine Tool Co., 2700 Eleventh St., Rockford, Ill., has placed on the market a No. 5 "Rigidmil" which, except for being a larger size, is identical in principle and all general respects to the present "Rigidmil." As in the smaller machine, the column, base, and saddle are made one integral casting so as to provide a solid work support. The table top is 32 inches above the floor, which is a convenient loading height for the heavy class of work that the machine is designed to handle.

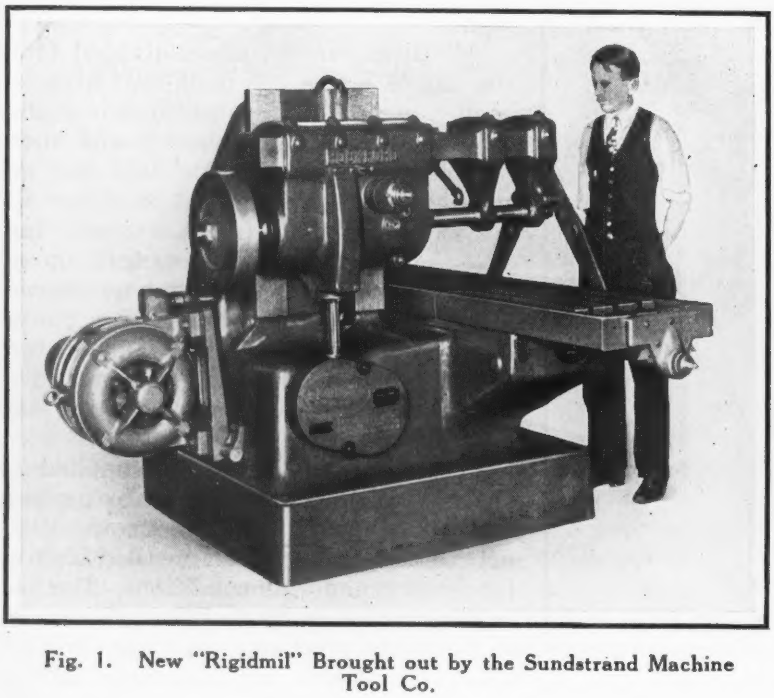


Fig. 1. New "Rigidmil" Brought out by the Sundstrand Machine Tool Co.

The spindle head is mounted on a wide slide having an improved type of gib which furnishes a solid metal-to-metal support without depending upon gib screws. Alignment is maintained by means of a long narrow guide. The head has a vertical adjustment of 13 inches; the minimum distance from the center of the arbor to the top of the table is 3 inches, and the maximum distance, 16 inches.

The spindle has a micrometer horizontal adjustment of 4 inches, effected by a 7-inch diameter bronze-bushed hardened and ground steel quill. A third bearing at the rear gives a much increased length of bearing to the spindle. The spindle head is equipped with a solid rectangular steel over-arm, measuring 4 by 8 inches in cross-section. The standard construction diagonal clamp is used to firmly bind on all four sides. A rack-and-pinion mechanism provides for easy adjustment.

The entire speed mechanism, from the pulley up to and including the main spindle gear, is equipped with Timken bearings. On the primary shaft is mounted a multiple disk friction clutch. The main pulley shaft extends through the machine for the entire width, and is the primary pick-off gear shaft. The secondary pick-off gear shaft carries a small bevel pinion which meshes with a bevel gear. The second bevel gear is broached to receive the splined vertical drive shaft. A spiral-bevel pinion made integral with this splined shaft drives a 14-inch diameter spiral-bevel gear which delivers power to the spindle. The spindle is equipped with a heavy flywheel, which eliminates chatter. Through the pick-off gears, there is a range of spindle speeds of from 50 to 180 revolutions per minute. All shafts are of alloy steel, hardened and ground.

The table is provided with a power feed and rapid traverse in either direction, controlled by a single lever. The power rapid traverse operates at a constant speed of 150 inches per minute,

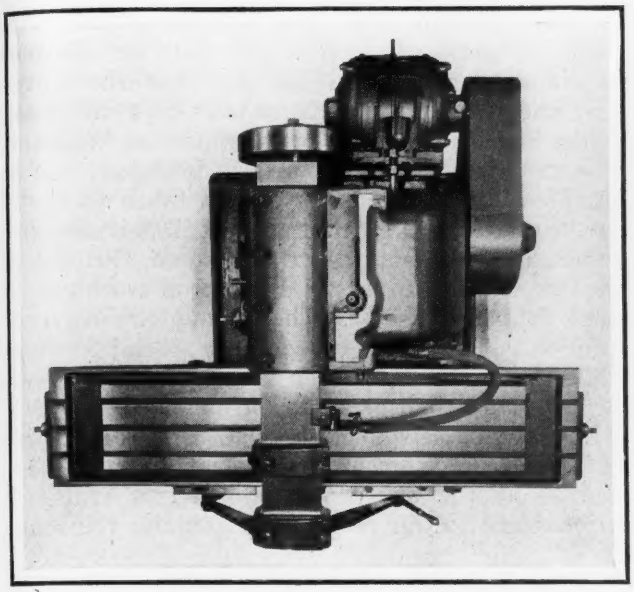


Fig. 3. Top View of a Motor-driven Machine

through a multiple disk clutch. The normal feeds are from 3 1/2 to 38 inches per minute, but a compound unit can be furnished to give feeds as low as 3/4 inch per minute.

The feed unit, like the speed unit, is self-contained, bolted to the front of the machine and carries the entire mechanism, including the gear that drives the table screw, all parts running in a bath of oil. The drive is direct from the speed-box through a shaft and multiple disk safety clutch which slips under excessive loads. The standard lengths of feed provided are 42, 48, and 60 inches. A saddle of unusual length and bearing area makes possible this range of feeds on the standard bed without excessive overhang.

Convenience of operation is one of the particular features. The starting lever is at the front of the machine to the right of the feed-box, the feed and rapid traverse are operated through a single lever at the center, and the vertical adjustment of the spindle head is made at the left. The feed and rapid traverse are regularly engaged manually, but automatic operation for the rapid return of the table can be provided for.

Coolant is delivered by a geared pump, having a capacity for delivering twelve gallons of fluid per minute, through a large-diameter flexible hose which delivers the coolant at a low velocity. The coolant is returned through large screened pockets in the table to a trough at the rear of the saddle slide. The coolant tank has a capacity of 50 gallons, and is located in the base. To take care of excessive splash, a large pan can be provided. The floor space required for this machine is 60 by 140 inches, and the total column height is 62 inches.

When equipped with a motor drive, the motor is mounted on the adjustable leaf hinged to the back of the machine, as shown in Fig. 1. The drive to the machine is through either a belt or chain. A motor of from 10 to 20 horsepower is recommended. The net weight of the machine is approximately 10,000 pounds.

CINCINNATI SELF-CONTAINED UNIVERSAL GRINDERS

Various sizes of completely motor-driven universal grinding machines are now being introduced to the trade by Cincinnati Grinders, Inc., Cincinnati, Ohio. The sizes range from 12 by 24 inches to 16 by 72 inches. Each machine is driven by three motors, there being one motor for the headstock, another for the grinding-wheel spindle, and a third for the work-table and coolant pump.

The drive to the headstock is obtained by means of a motor mounted in the headstock housing. A sprocket on the shaft of this motor transmits power through a silent chain to a sprocket fixed to a worm-shaft. The worm, in turn, drives a worm-wheel to which the headstock drive plate is fastened. Endwise adjustment of the motor frame on the headstock housing is provided to take up wear of the chain. The headstock motor is of 3/4 horsepower capacity, and of the adjustable-speed type, providing speeds of from 600 to 1800 revolutions per minute.

The drive to the wheel-spindle is obtained through a single-speed five-horsepower motor running at 1700 revolutions per minute. The connection between this motor and a pulley on the wheel-spindle is made by means of an endless belt, which runs over an idler that compensates for stretch of the belt. The drive to the speed-change box furnished for the work-table traverse and to the coolant pump is by means of a one-horsepower, constant-speed motor running at 1150 revolutions per minute.

While the headstock motor must invariably be of the direct-current type for operation on 230-volt current, the other two motors can be supplied for either direct or alternating current. For installations where 230-volt direct current is not available, the machine can be equipped with a direct-current generator. The generator is mounted at the rear, and is driven direct by the motor that delivers power to the table gear-box and to the coolant pump. In such a case, however, a 1 1/2-horsepower motor is furnished for this drive.

With the exception of the motor equipment, these machines closely follow the design of the

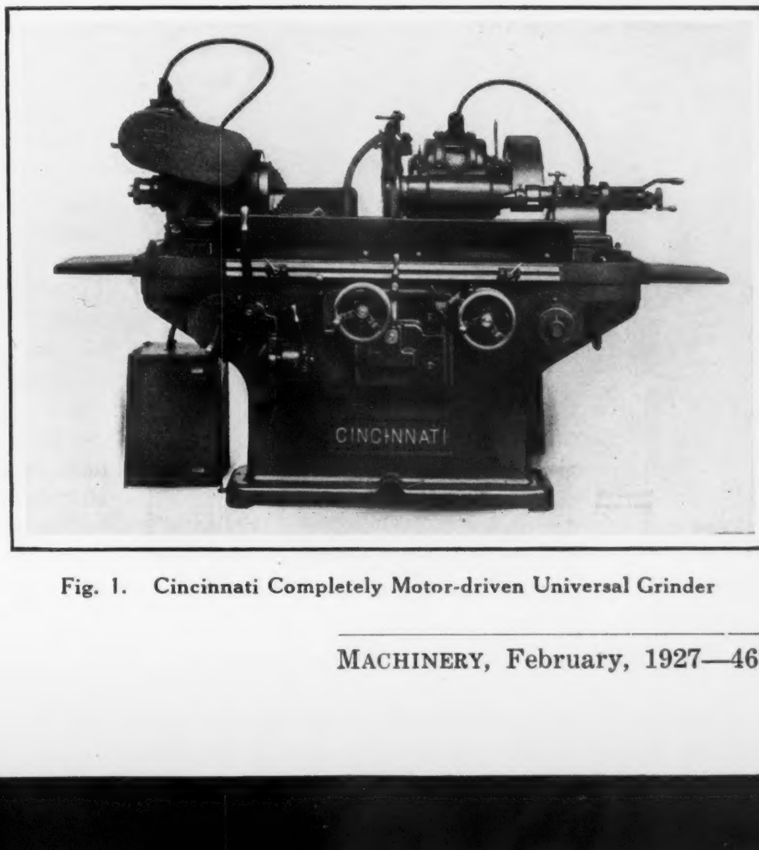


Fig. 1. Cincinnati Completely Motor-driven Universal Grinder

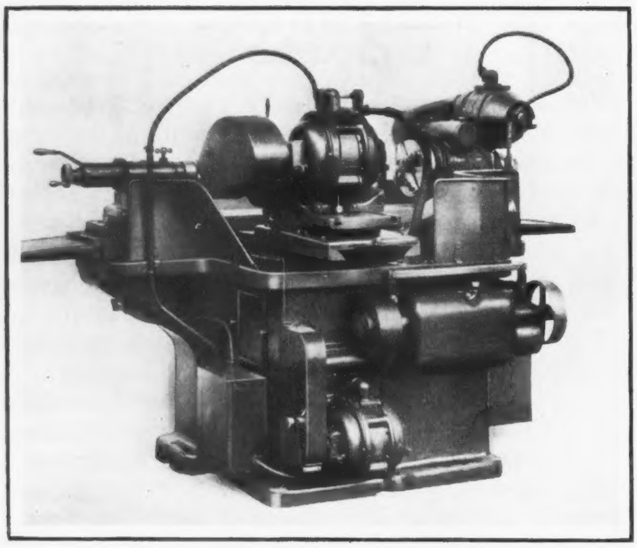


Fig. 2. Rear View of Cincinnati Grinding Machine, Showing Arrangement of Motors

countershaft-driven universal machines built by this concern. Some of the features are a combined live- and dead-spindle headstock; sliding gears for changing the table traverse speeds; a sensitive cross-feed; and a centralized control. The weight of the self-contained machines, equipped with all motors, ranges from 5400 to 7560 pounds.

FOOTE BROS. WORM-GEAR SPEED REDUCERS

The spur-, worm-, and herringbone-gear reduction units manufactured by the Foote Bros. Gear & Machine Co., 232-242 N. Curtis St., Chicago, Ill., have recently been complemented by a line of "Hygrade" worm-gear units. The new line comprises type HGS, which has the worm at the bottom; type HGT, which has the worm at the top; type HGV, which has the worm-gear shaft vertical; and type HGD, which constitutes a combination of two units that give a double reduction for high ratios.

One of the features pointed out is that all parts for the different types are interchangeable, with the exception of the cases. All units are provided as standard, with ball bearings for the worm-gear and worm-gear shaft, to take both radial and thrust loads. However, radial roller bearings and, in some cases, babbitted bronze bearings, can be provided. Precautions have been taken to insure an adequate supply of lubricant to all moving parts under all conditions of load and speed. Provisions have been made to guard against oil working out along extending shafts. The worm-gears are made from chilled and cast bronze of a special formula, while the worms are made from nickel steel, carburized, hardened, ground, and polished.

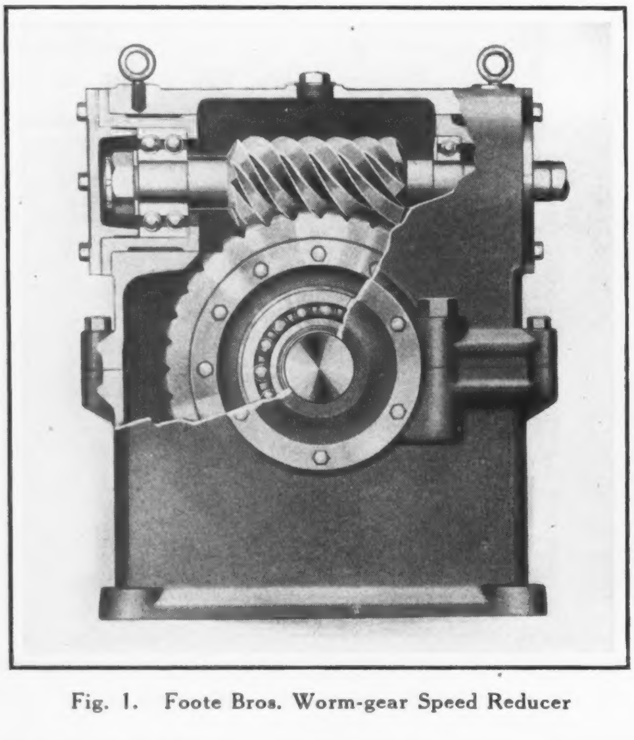


Fig. 1. Foote Bros. Worm-gear Speed Reducer

In the double-reduction type HGD, reduction ratios ranging from 50 to 1 up to 10,000 to 1 are secured by the use of two worm-gear trains in series. The initial reduction is obtained through

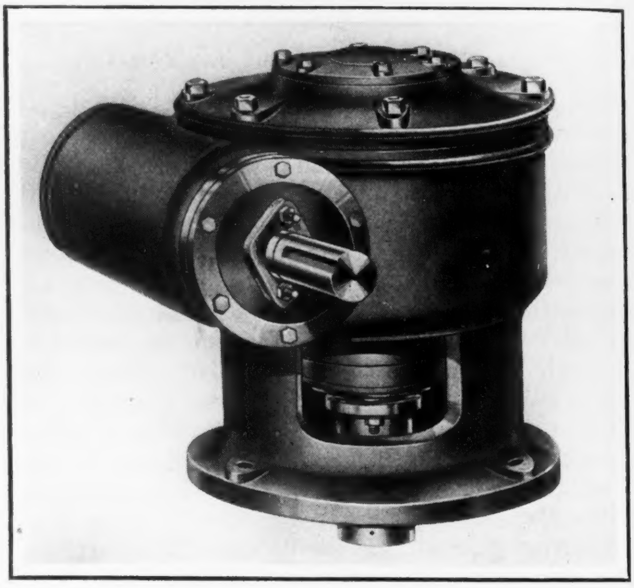


Fig. 2. Reducer Having a Vertical Worm-gear Shaft

a worm and gear of comparatively small size and pitch, which are enclosed in a unit housing that can be bolted to the frame of a standard HGS, HGT, or HGV reducer to provide for the larger reduction ratios. It is claimed that efficiencies can be maintained at a high average, since two units of comparatively high efficiencies are used.

"PYRO" RADIATION PYROMETER

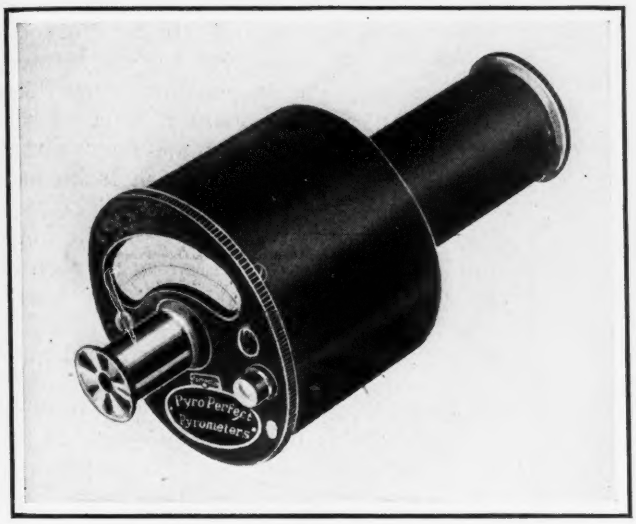
A development of the "total radiation" type of pyrometer is being placed on the market by the Pyrometer Instrument Co., 74 Reade St., New York City, for use in commercial heat-treatment processes. In commercial pyrometers of this type, a predetermined portion of the radiation emitted by a hot body is concentrated on a sensitive element, causing a measurable force to be developed in this element. In the "Pyro" instrument here illustrated, a clear quartz lens concentrates sufficient radiant energy on the thermo-couple to develop forces said to be fully as great as those developed by the actual immersion of base-metal thermo-couples.

The thermo-couple consists of an extremely thin wire attached to a thicker supporting wire, a receiving disk being fixed over the joint. The whole

couple is then mounted in an evacuated glass bulb, and adjusted in the axis of the optical system. Claims made for this patented construction are a speedy response to temperature variations and the development of higher forces due to the higher actual temperature reached by the thermo-couple for a given amount of radiation impinging on it.

The instrument is of the fixed-focus type in which the distance between the lens and the thermo-couple is not adjustable by the operator. The distance at which the average instrument is used from the aperture may be as great as from twenty-four to thirty times the diameter of the aperture. The instrument is provided with an eye-piece which allows full view of the hot body being sighted, a sliding adjustment of the eye-piece being employed to bring the object clearly into view.

A practical feature of the instrument is the incorporation of the millivoltmeter, thermo-couple,



"Pyro" Compact Radiation Pyrometer

and optical system in a single unit, eliminating all accessories. It is mentioned that in a test consisting of checking the temperatures in gas retort benches, 280 readings were obtained and recorded in less than 3 1/2 hours. This is equivalent to one reading every 45 seconds.

MILLING ATTACHMENT FOR DRILLING MACHINES

A Hawkins milling attachment designed for application to 16-inch and larger drilling machines has just been placed on the market by John W. Chapman & Co., Warsaw, Ind. This device is portable, weighing only about 140 pounds, and can be readily applied to machines located in different parts of a shop. It is driven by connecting direct to the spindle of the drilling machine, being provided with either a No. 3 Morse taper shank or a straight shank. The shank drives the attachment proper through a universal joint.

This attachment is made in plain and semi-universal styles, the illustration showing the plain style mounted on a machine ready to perform any of twenty-three milling operations which come under common machine-shop practice. The attachment can also be arranged for turning work, by mounting a three-jaw chuck on the spindle and fitting the table with a special tool-holder. In addi-

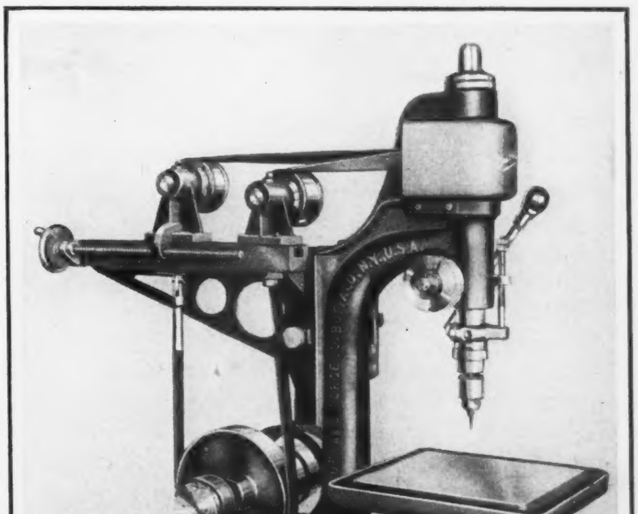
Hawkins Milling Attachment for Drilling Machines

tion, it can be used for cutting-off, drilling, boring, and reaming operations.

Independent hand feeds are provided for the head, table, and spindle. The feed-screws are equipped with micrometer dials. Dividing heads, universal angle-plates, swivel vises, etc., can be applied, and all standard milling cutters can be used.

BUFFALO DRILLING MACHINE

Four spindle speeds, of 3600, 4800, 7200, and 10,000 revolutions per minute, are quickly obtainable in a "Hi-Speed" drilling machine recently designed by the Buffalo Forge Co., 144 Mortimer St., Buffalo, N. Y. This range of speeds is provided with a view to enabling the operator to get maximum cutting efficiency out of drills by running



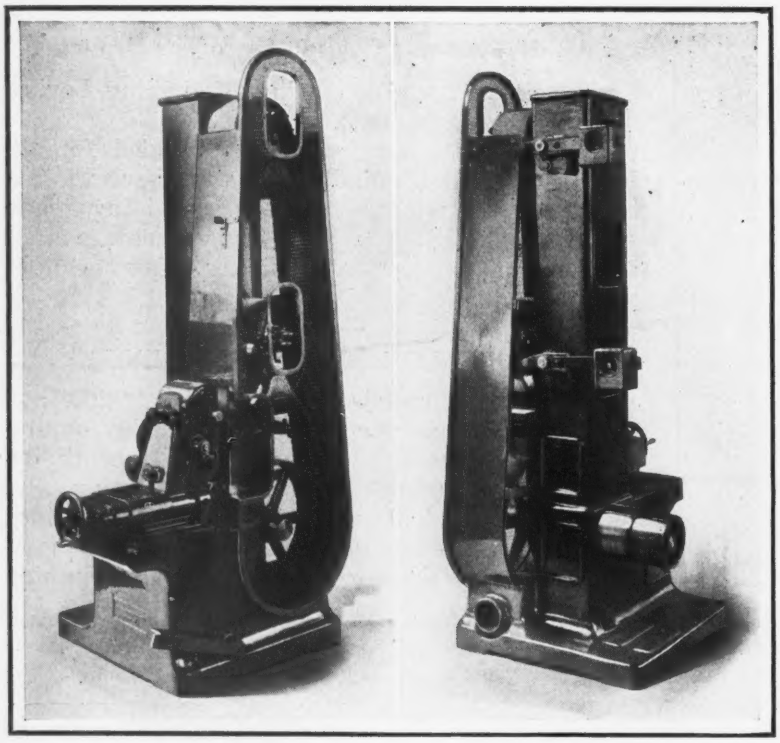
Buffalo High-speed Drilling Machine

them at the correct speeds for different materials and sizes of drills.

Changes from one speed to another are quickly made through a lever and quick-acting screw. The machine is particularly recommended for production operations in the automotive industries, instrument-making plants, etc. It is equipped with a Jacobs chuck having a capacity for drills up to 5/16 inch in diameter. In addition to the style shown, the machine is also built with a 1/2-horsepower direct motor drive. The net weight of the belt-driven machine is about 215 pounds.

CENTERLESS-FEED POLISHING MACHINE

A centerless-feed polishing machine designed primarily for cylindrical work, but which may also be used for polishing flat and other shaped parts, is being placed on the market by the Production Machine Co., Greenfield, Mass. This machine is similar in principle to the type A polishing machine built by the same concern, but the new machine is more substantial and has refinements that facilitate operation and adjustment and add to the life of the machine, as well as lessening the operating cost.



Production Polishing Machine with Centerless Feed

A new feature is a patented centerless feed which extends the field of usefulness of this type of polishing machine. The class of work may range from coarse cleaning or finishing to the finest lapping, polishing, buffing, coloring, etc., of parts made from iron, steel, brass, aluminum, copper, wood, rubber, celluloid, fiber, and various compositions.

Briefly, the new feed consists of an endless belt which is driven from the main shaft below. Provision has been made for tilting the feed unit to obtain more or less feed. Adjustments for various diameters of work are controlled through a convenient handwheel. The work-rest is connected with this adjusting mechanism, and the rest always assumes the same relative position, whether the work is 1/4 or 6 inches in diameter, these being the minimum and maximum diameters of work that can be accommodated. The construction just described tends to make the setting up of the machine fool-proof.

The polishing belt is brought into action on the work by means of a foot-lever which is manipulated to operate a pressure platen in back of the belt. This platen is independently adjustable, and provision is made for changing platens to suit various kinds of work. The machine employs an abrasive belt 6 inches wide and 14 feet long.

A tension device has been provided to give uniform tension to the belts at all times. The device for changing the track of the belts is controlled by two handwheels on each top and center pulley, one handwheel being used to make the adjustment and the other to lock the screw. The shafts on which these pulleys operate have a rocking movement to permit the adjustment to be made. The yokes that carry these pulleys have been made a part of the slide. They travel on planed ways that are similar to the ways of a lathe bed, except that they are vertical. The vertical movement is controlled by the horizontal tension levers and weights seen in the rear view.

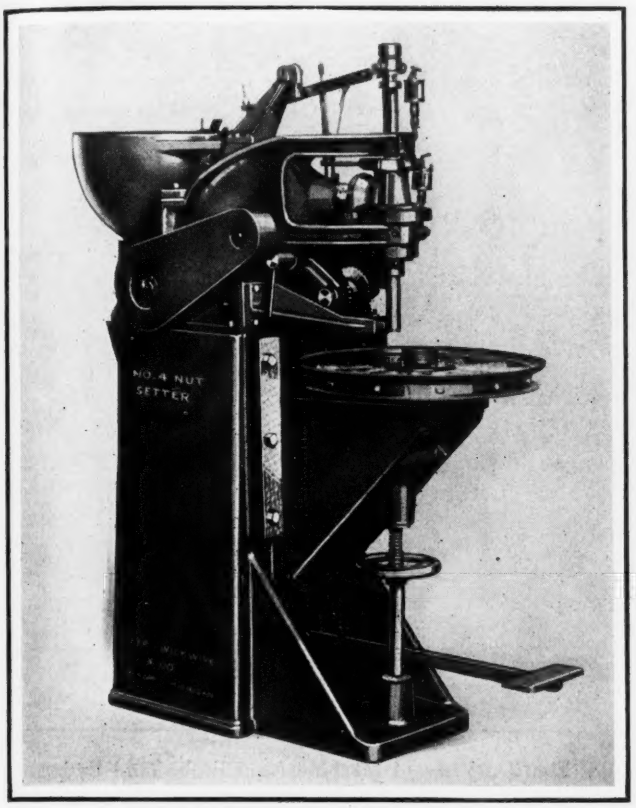
A 10-horsepower motor is required to drive the machine; however, a tight-and-loose pulley drive is usually supplied. When a motor is furnished, a flexible coupling is applied to the main drive shaft. The main drive is located in the base. Ball bearings are used throughout.

TEER-WICKWIRE NUT SETTER

A high-speed machine arranged to assemble nuts on automobile wheel hubs, but which may be used for setting nuts on any unit that can be conveniently moved under the spindle, is shown in the accompanying illustration. This is a recent product of Teer, Wickwire & Co., 113-117 E. Washington St., Jackson, Mich. It is equipped with a hopper which automatically delivers nuts with the proper face upward to a trough.

From this trough the nuts are forced into the spindle, one at a time, through an opening that registers with the end of the trough when the spindle is in the upper position. The nuts are forced down to the lower end of a socket wrench by a pusher inside the spindle, which also furnishes a solid backing for the top of the nuts and prevents the starting of cross threads.

The operator merely lines up beneath the spindle the screw on which a nut is to be set, and then presses the foot-treadle. The spindle descends and engages the nut with the screw. Almost instantly, the nut is tightened on the screw to the required tension, which is predetermined by means of a friction clutch. Next, the operator allows the treadle to return, the friction clutch disengages, and the spindle returns to the upper position.

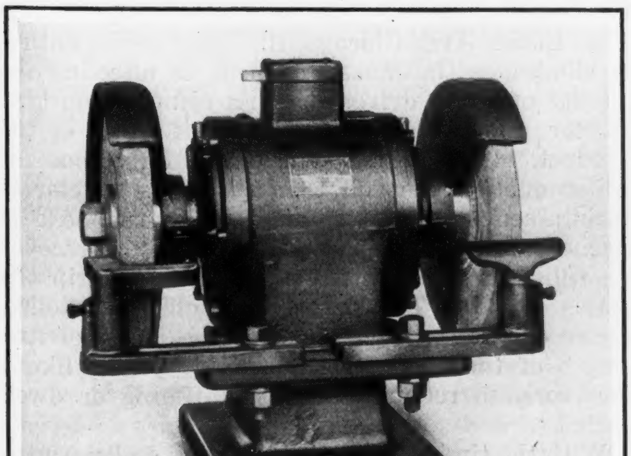


Teer-Wickwire Nut Setting Machine

The No. 4 machine shown handles nuts from 5/16 to 1/2 inch, inclusive, and is driven by a two-horsepower motor. Other sizes of machines are being brought out, including a small bench type.

BENCH AND PEDESTAL GRINDERS

Four sizes of motor-driven bench and pedestal grinders, equipped with ball bearings, have recently been added to the line of electric tools manufactured by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio. These grinders are built in 1/4-, 1/2-, 1-, and 2-horsepower sizes for operation on alternating and direct current. The armature shafts are made of nickel steel, and the ball bearings are mounted in dustproof chambers. The switch is located on top of the motor housing, and is of the quick make-and-break type.

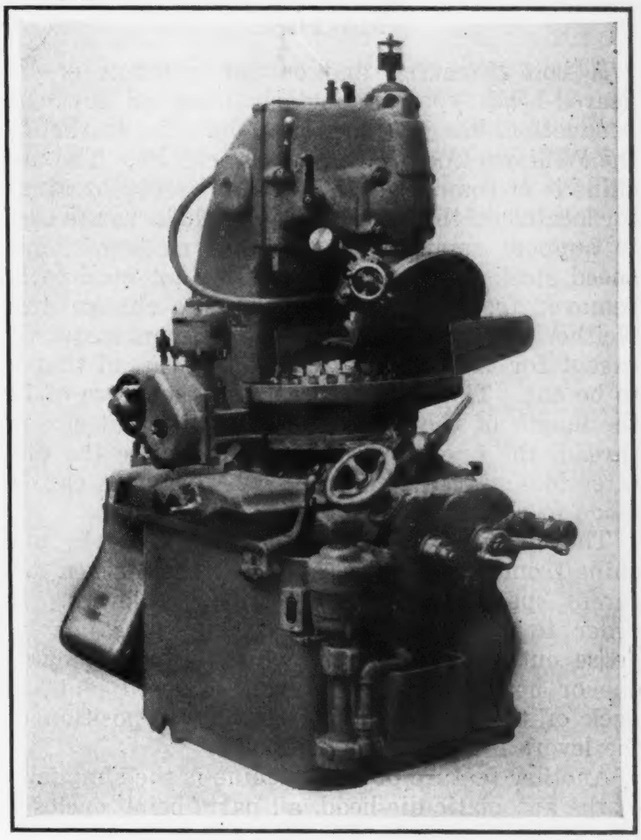


Motor-driven Bench Grinder

GLEASON SPIRAL-BEVEL GEAR-CUTTER SHARPENER

An automatic wet grinding machine for sharpening spiral-bevel gear cutters has recently been placed on the market by the Gleason Works, Rochester, N. Y. This is a 12-inch machine intended for grinding the blades of cutters 6, 9, and 12 inches in diameter. Power for driving the grinding wheel and table, indexing mechanism, and water pump is supplied by three separate motors.

Grinding is accomplished by the conical side of a 14-inch wheel, the wheel being carried on a ball-bearing mounted spindle. Spiral-bevel gears transmit the power to the wheel-spindle from a vertical shaft driven through a belt by a three-horsepower motor mounted in the base of the machine. A 1/4-horsepower built-in type of motor operates the indexing mechanism, and another motor of the same



Gleason Automatic Gear-cutter Sharpener

size and type drives a pump having a capacity for delivering twelve gallons of fluid per minute.

The cutters are rough-sharpened by taking twelve grinding cuts in quick succession on each blade. Every fifteen seconds the indexing mechanism operates to bring the next blade in position. During the indexing, the table is automatically moved back 0.012 inch, so that each succeeding blade is presented to the wheel from the same starting position.

The indexing mechanism is of the stop-wheel type, and turns the work the correct amount for cutters having both inside and outside blades or for cutters having all inside or all outside blades. After the rough-sharpening, a clutch is shifted to engage a different part of the feed cam, so that instead of twelve cuts being taken on each blade,

the cutter passes across the wheel and back once, then indexes, and feeds in approximately 0.001 inch.

Grinding with the conical side of the wheel gives a line contact that prevents unnecessary burning of the blades. A high degree of finish is obtained due to the means of dressing the wheel and to the fact that the feed of the work is moderate.

The cutter-holder has a cradle base to permit it to be tilted to different angles for sharpening cutters of different blade angles. By means of graduated dials, the table may be offset so that, together with tilting the cutter, the proper location can be obtained for accurate sharpening. The advantages claimed for the machine are more gears per grind of cutters, less waste in grinding the cutting tools and the possibility of one man operating two machines.

"RAPIDUCTION" BOLT THREADING MACHINE

A bolt threading and cutting machine of the geared-head type, particularly designed for high production, has just been placed on the market by the Williams Tool Corporation, Erie, Pa. The machine is of compact design, and is driven by a motor located on the base. Large die-holders are used to support small renewable dies made of high-speed steel. These die-holders do not need to be removed from the head in order to change dies. Neither is any special head adjustment required, except for the actual fitting of the thread that is to be cut. The size of thread is taken care of by the length of the dies. To cut a different size of thread, the operator can quickly change the dies after loosening a locking screw. Changes can be made in a few seconds.

The operator has complete control of the machine from one position, and can obtain seven different speeds by operating only two levers. In order to change gears, it is only necessary to "ease out" on the clutch, which permits moving one or both gear-shift levers. A speed plate in back of the levers shows the correct position of the levers for each size of bolt.

Another feature of the machine is the simplicity of the automatic die-head, all parts being enclosed

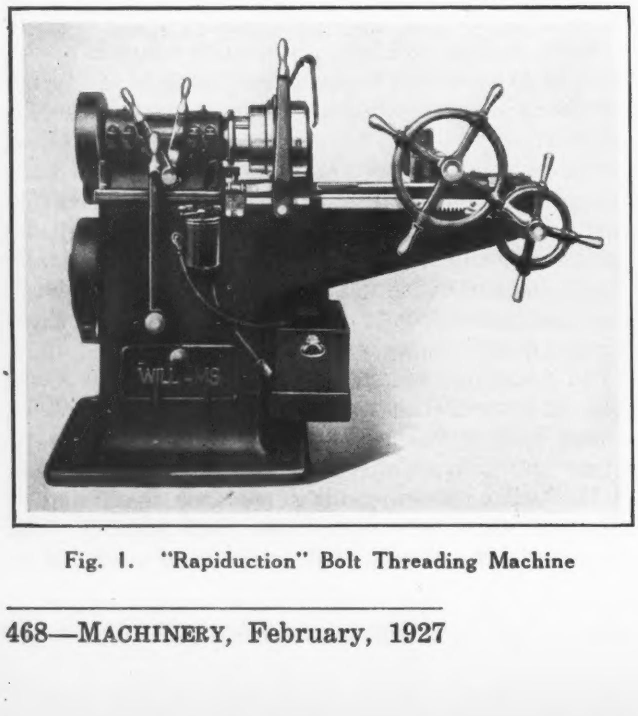


Fig. 1. "Rapiduction" Bolt Threading Machine

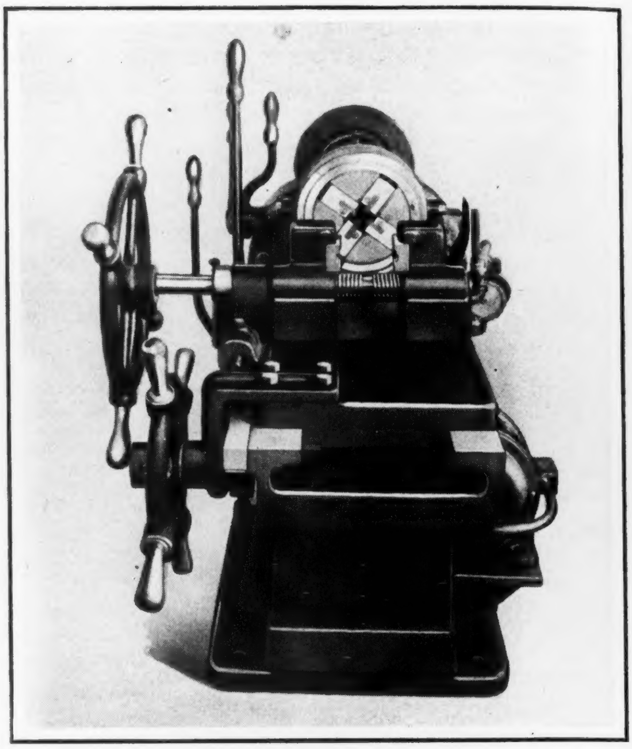


Fig. 2. View of Machine from Right-hand End

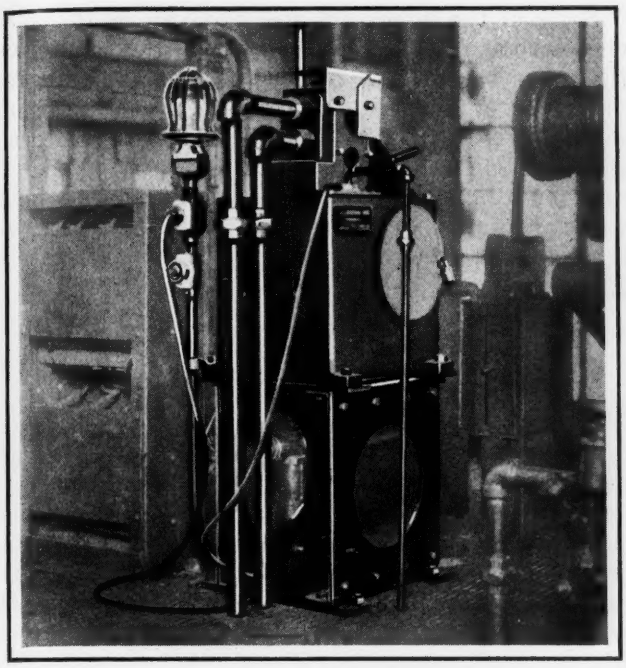
to form one compact unit. The shell, which is controlled by compression springs, travels backward and forward on the die-head and, in turn, opens and closes the dies. The head is adjusted by pulling the lever forward, and is released by a trip-rod on the carriage. This trip-rod can be set to give any desired length of thread within the capacity of the machine.

The dies are adjusted by releasing the cam ring from the shell. For this purpose, a spanner wrench is engaged in the cam ring and moved backward or forward until the die has been adjusted to the size of thread to be cut. The cam ring is then locked to the shell, retaining the die-holders in a fixed position.

HANNA RIVETER TIMING VALVE

A valve that automatically controls the length of time during which the full tonnage of a riveter remains on the rivet after it is driven is a recent development of the Hanna Engineering Works, 1763 Elston Ave., Chicago, Ill. This device entirely eliminates the human element as affecting the quality of rivets driven hot in a compression type riveter, and, therefore, insures uniformity of the product. In driving rivets, particularly those of boiler quality, the full tonnage of the riveter is maintained on the rivet after its driven head is formed, until the rivet cools sufficiently to recover its full cold strength, fill the hole, and grip the plates tightly. The period for sufficient cooling under die pressure varies with the diameter and length of the rivet. Each riveting job is likely, therefore, to require a different timing or dwell period.

With the timing valve, it is possible to determine accurately the dwell period that will insure tight rivets for each job. Thereafter, the valve can be depended upon to insure a sufficient dwell on all rivets. It was found, in one instance, that tight



Timing Valve for Hanna Riveters

rivets were obtained with a dwell of 10 seconds, whereas 15 seconds had formerly been the standard time without the timing mechanism. It is also stated that the percentage of loose rivets was reduced to nil, that a 50 per cent increase in production resulted, and that the cost of cutting out and redriving rivets was almost eliminated.

With the installation illustrated, the operator depresses the valve handle to make the rivet die advance on the rivet. When each rivet is driven half way, the valve goes beyond the control of the operator. The riveter then finishes and dwells on the rivet for the predetermined period, and at the expiration of this time, the valve automatically reverses to return the riveter mechanism to the starting position. The valve may be reversed manually as the rivet die is advancing, before the die strikes the rivet. This constitutes an important safety feature.

The valve may be set for any duration of dwell from 1 to 60 seconds. Settings are made by direct reading, and the valve may be sealed so that a setting cannot be tampered with unless a padlock seal is broken. The valve is a self-contained unit, which may be placed at any point for convenient operation. The timing element consists of a constant-speed fractional-horsepower motor equipped with a gear reduction.

HOLD-DOWN FOR NIAGARA SHEARS

A new type of squaring-shear hold-down, which is particularly adaptable to long squaring shears, has recently been designed by the Niagara Machine & Tool Works, 637-697 Northland Ave., Buffalo, N. Y. Application has been made for a patent to cover this device. The hold-down combines lightness and rigidity, and clamps the sheet securely and uniformly, with the result that a clean accurate cut is obtainable. Visibility of the cutting line is another advantage.

The device works automatically, and is made to grip the sheet firmly until the cutting is completed. The horizontal member of the hold-down is a steel channel, which is guided on finished surfaces at both ends. Each foot of the hold-down is provided with an individual spring cushion; hence, the feet are self-adjusting for wear and for different thicknesses of material.

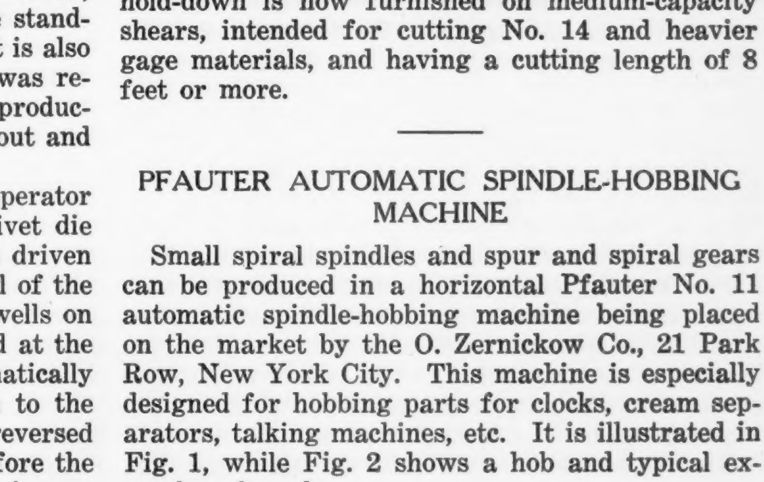
Unevenness of metal, kinks in the sheet, dirt, etc., are compensated for locally without disturbing the gripping pressure at any point. Sheets shorter than the length of the shear are gripped with uniformity and without tilting the hold-down, regardless of whether the sheets are cut in the center or toward one end of the shear. The pressure exerted by each foot is independently adjustable, so that a varying clamping pressure may be obtained if desired.

The hold-down is operated by two cams on the main shaft of the machine. Levers actuated by these cams close a toggle to bring the device into play. A little force delivered by the cams, results in considerable pressure on the hold-down. After a cut has been completed, the device is raised by completely encased compression springs. This hold-down is now furnished on medium-capacity shears, intended for cutting No. 14 and heavier gage materials, and having a cutting length of 8 feet or more.

PFAUTER AUTOMATIC SPINDLE-HOBBING MACHINE

Small spiral spindles and spur and spiral gears can be produced in a horizontal Pfauter No. 11 automatic spindle-hobbing machine being placed on the market by the O. Zernickow Co., 21 Park Row, New York City. This machine is especially designed for hobbing parts for clocks, cream separators, talking machines, etc. It is illustrated in Fig. 1, while Fig. 2 shows a hob and typical examples of work.

The machine is equipped with a cone pulley for driving from an overhead countershaft. Hob speeds can be varied to suit the work and the hob. The dividing gear drive consists of a worm-gear which runs in a dustproof oil bath. For this drive, power is taken from the cone pulley shaft and delivered through indexing change-gears to the di-



Niagara Squaring Shears Equipped with New Hold-down

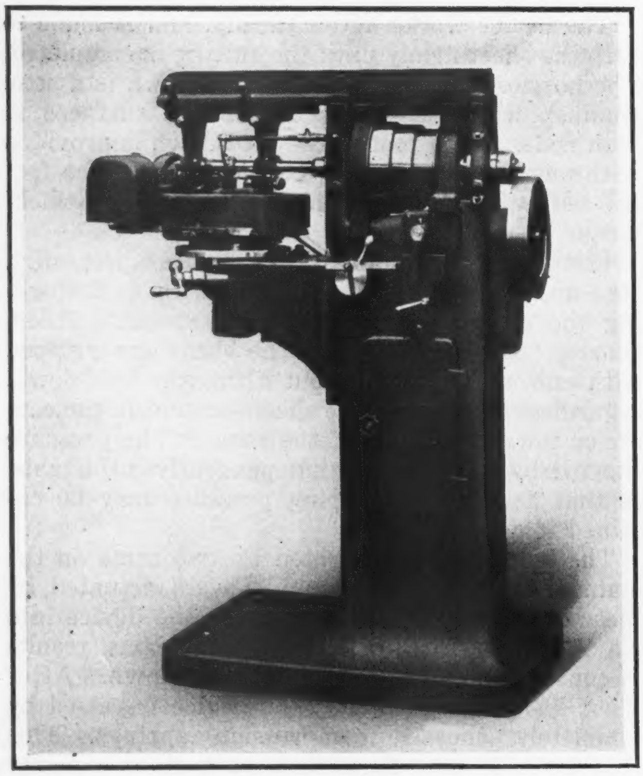


Fig. 1. Pfauter Automatic Spindle-hobbing Machine

viding worm-shaft. Thus, the cutter-spindle and work rotate in the correct relation, and indexing is effected automatically.

The work is held horizontally, either between centers or in a draw-in collet. The work-table travels in a swiveling slide mounted on the knee. By means of this slide, which is equipped with a graduated scale, the work can be set readily at any desired angle relative to the hob. A small support receives the cutting pressure of the hob when slender work is being handled. All the teeth on the work are produced in feeding the work once horizontally across the face of the hob. The rate of automatic hobbing feed can be chosen to suit both the work and the hob. The feed can be stopped automatically or by hand. As this is essentially a production machine, in which the range of work is limited, there is no differential gear. The movement that the dividing wheel spindle must make, in addition to the indexing movement, is considered in calculating the dividing change-gears. Change-gears necessary for cutting the teeth on one spindle are furnished with the machine.

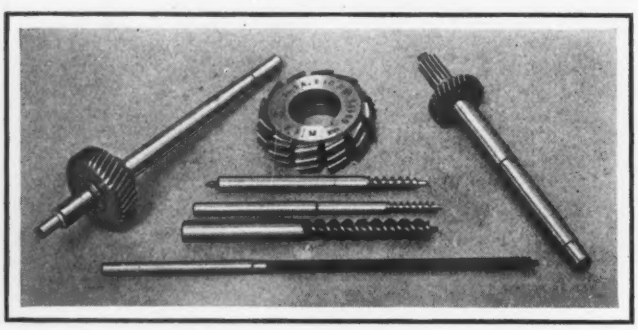


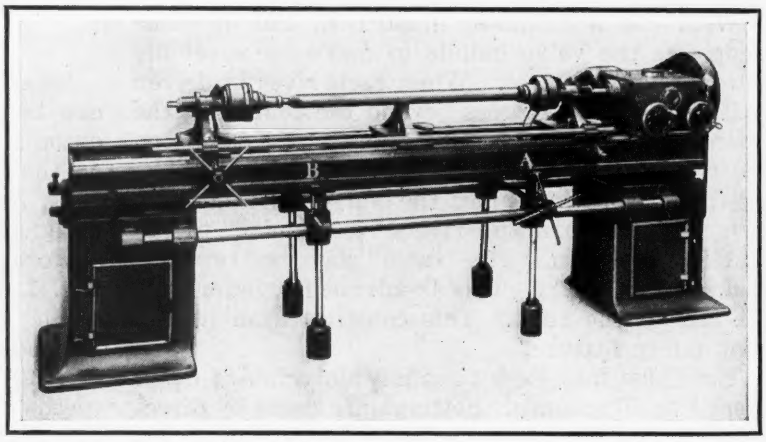
Fig. 2. Hob and Typical Examples of Work

Some of the important specifications of this machine are as follows: Maximum width of tooth face that can be hobbed, 5 29/32 inches; maximum diameter of spindle, 1 3/16 inches; maximum diameter of hob, 1 9/16 inches; number of teeth that can be hobbed, from 2 to 100; minimum and maximum axial distances between the hob and work-arbors, 25/32 and 1 31/32 inches, respectively; and net weight of machine, approximately 1200 pounds.

TINIUS OLSEN BALANCING MACHINE

The latest center-suspension form of balancing machine built by the Tinius Olsen Testing Machine Co., 500 N. 12th St., Philadelphia, Pa., as here illustrated, is especially arranged for determining the dynamic balance of propeller shafts. The machine indicates on dials, in ounce-inches, the unbalance at either end of the shaft or at the points where correction is to be made. It also indicates the angle of unbalance. The propeller shafts are held in place by magnetic chucks, so that they can be quickly and easily inserted and removed. The shafts need not be reversed or removed during a checking, and readings are made before they are removed.

This machine is of the computing type, and with it, parts can be checked for unbalance at the rate of from 150 to 200 parts per day of nine hours.



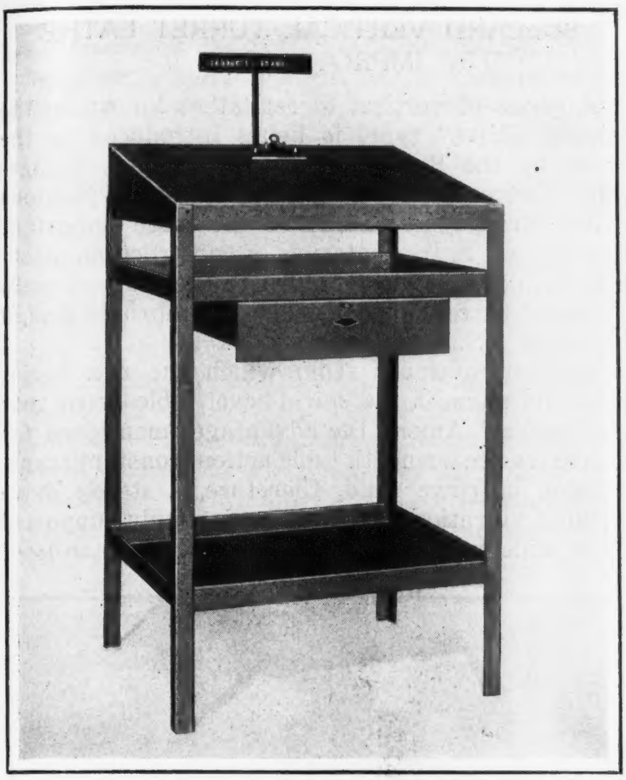
Tinius Olsen Balancing Machine Arranged for Checking Propeller Shafts

The propeller shafts are checked at the rate of 25 shafts per hour.

POLLARD SHOP DESK

The metal shop desk here illustrated has recently been added to the line of factory equipment made by the Pollard Bros. Mfg. Co., Inc., 4035 N. Tripp Ave., Chicago, Ill. This desk is 40 inches high at the front and 45 inches at the rear, thus giving a slope to the top that is convenient to a man writing while standing. The desk is made in two sizes—24 by 30 inches and 24 by 36 inches.

A paper clip is fastened to the top of the desk for holding blueprints, orders, memoranda, etc. There is also a label-holder at the rear in which the name of the man using the desk may be conspicuously displayed. The two pans may be used for stowing tools, parts, etc., and the drawer serves as a safe place in which to keep private tools, as



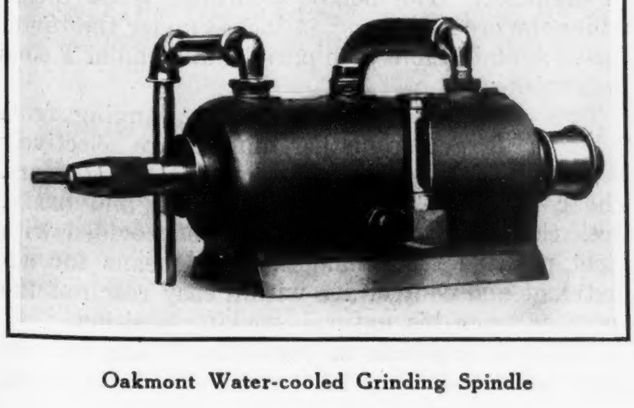
Pollard Desk Intended for Shop Use

it is furnished with a lock. Desks that must be frequently moved from place to place in a shop can be supplied with casters.

OAKMONT INTERNAL GRINDING SPINDLE

A water-cooled wheel-head has recently been developed by the Oakmont Mfg. Co., P. O. 69th and Market Sts., Philadelphia, Pa., for use on the "Omco" internal grinder built by this firm. The shaft of this wheel-head is made from one piece of alloy steel which, after being hardened and tempered, is ground to size in three operations, between which it is seasoned. The shaft is finally balanced dynamically. There are two straight bearings which run in bronze sleeves that are tapered and keyed on the outside and slit to permit adjustment. The entire pulley-bearing assembly slides in the housing to give the desired amount of float.

An oil reservoir is located between the bearings, and this oil chamber is so designed that the shaft sends oil under pressure to the bearing feed-lines. After being forced through the bearings, the oil returns by gravity to the reservoir. The sight-feed oil gage on the front of the head shows how much oil is in the reservoir.



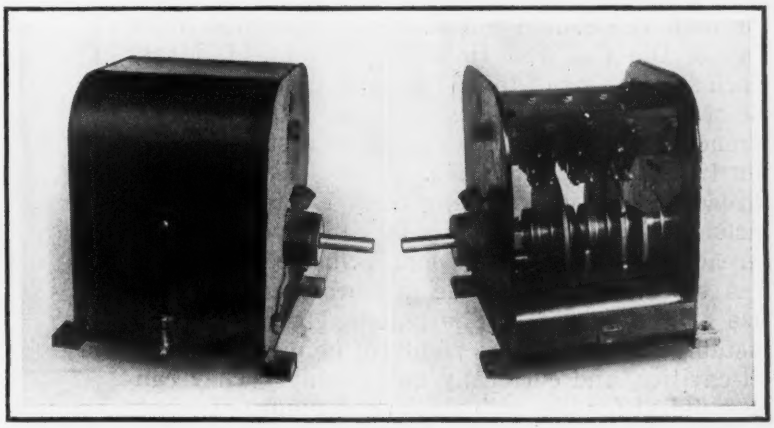
Oakmont Water-cooled Grinding Spindle

An important feature of the head is that the oil chamber and both bearings are surrounded by a generous cooling jacket through which the ordinary grinding coolant is constantly pumped. By keeping the bearings and the oil cool, the oil is maintained at an even viscosity and gives a constant uniform film on the bearings. It is stated that after twenty-four hours of continuous operation, no portion of the spindle will be more than a few degrees warmer than the temperature of the cooling water. Since a uniform film of oil is maintained, the bearing wear is reduced to a minimum.

ROTATING CAM LIMIT SWITCH

A rotating cam limit switch designed to be used with magnetic controllers for the automatic control of machines having such fixed sequences of operation as slowing down, stopping, and reversing, is here illustrated. This switch constitutes a recent development of the Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. It is totally enclosed, equipped with tapered roller bearings, and will carry up to six sets of contacts.

Cams open and close the contacts, these cams being adjustable independently of one another. They can be fixed in an infinite number of positions, and thus afford flexibility to the machine with which the switch is used.

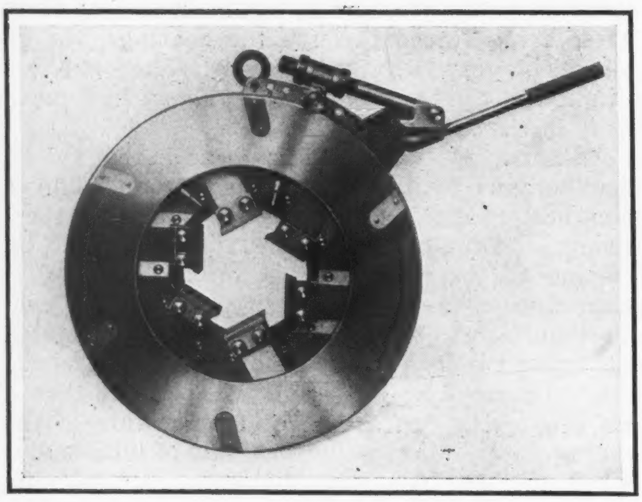


Electric Switch for Machines Having a Fixed Sequence of Operations

COX PIPE THREADING DIE

A tangential "Clean Cutter" pipe threading die, recently brought out by the Cox & Sons Co., Bridgeton, N. J., is shown in the accompanying illustration. All working parts of this die are fully enclosed, and can be adjusted for each size of pipe. Through a micrometer adjustment, compensation can be made for plus or minus standard pipe sizes.

The chaser clamping edges are tapered longitudinally, and have a serrated clamping surface for the entire length. Each chaser is held rigidly in position on a block by means of a toggle clamp and screws. Non-slippage is claimed as a feature for the construction.



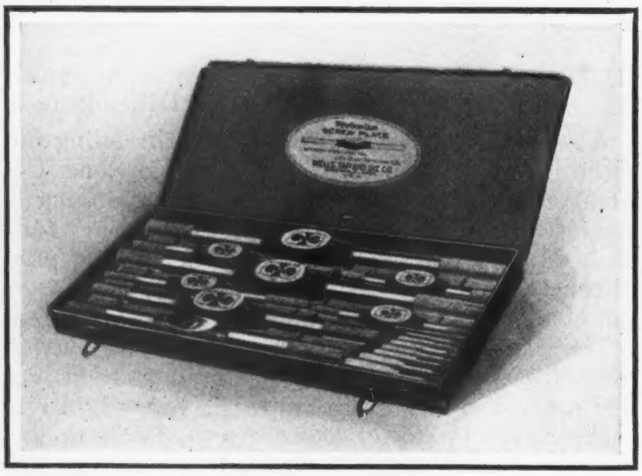
Cox Tangential Pipe Threading Die

All chasers are adjusted to the same relative cutting position by the use of a fixed gage, which is temporarily attached to the chaser block. Chaser adjustments are made from the front without dismantling the die. Cutting lubricant is delivered in front of the chaser cutting edges. This die can be used in conjunction with a standard attachment employed for threading bent pipe.

WELLS SCREW PLATE SETS

Screw plate sets known by the trade name of "Pee Dee Que" are being introduced to the trade for both U.S.S. and S.A.E. threads, by the Wells Tap & Die Co., 106 Hope St., Greenfield, Mass. Each set consists of taper taps, patented bevel dies, die-stocks, and an adjustable tap and reamer wrench, all of which are packed in a steel box, as illustrated. With the No. 50 set, five sizes of threads can be cut, ranging from 1/4 to 1/2 inch, inclusive, and with the No. 60 set, seven sizes of threads, from 1/4 to 3/4 inch, inclusive.

A stock, dies and guide are provided for each size of screw plate. The patented two-piece adjustable bevel dies have plenty of chip room, large oil cavities, and cut easily and cleanly. They can be supplied for use with stocks and guides of other makes. A large amount of chip clearance is provided on the die-stocks so that the chips will fall readily from the work. This feature is said to make the tool free-cutting and give a clean thread.

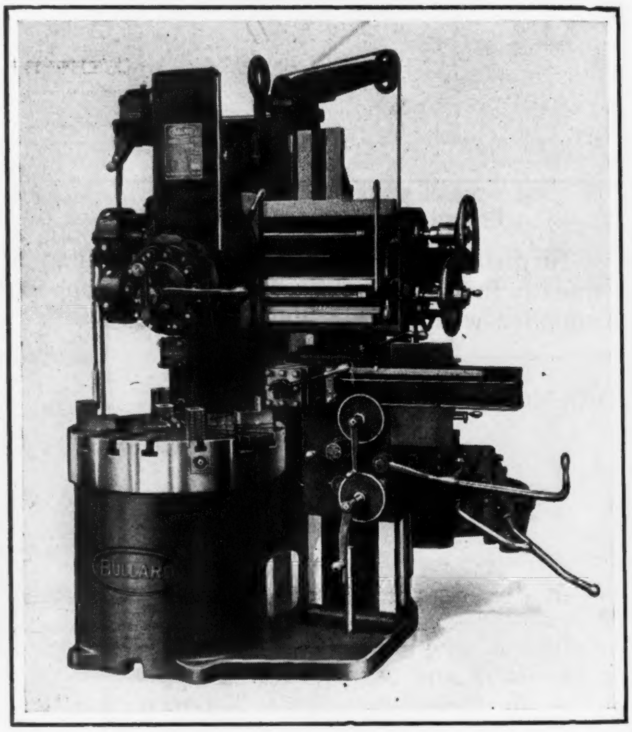


Wells Tap and Die Set

BULLARD VERTICAL TURRET LATHE IMPROVEMENTS

A series of vertical turret lathes known as the "Spiral Drive" type, is being introduced to the trade by the Bullard Machine Tool Co., Bridgeport, Conn. This series supersedes the previous "New Era" type. Some of the more important changes are in the materials of construction, attention being particularly called to the all-steel main slide and turret. There is also an improved design of turret locking mechanism.

The improvement from which the new series takes its name is the spiral-bevel table drive gear and pinion. Among the advantages mentioned for this drive are a smooth table action, constant transmission of power and, therefore, a steady drive without vibration. The pinion is amply supported by a wide bearing on each side. The gear is of the largest permissible diameter for each size of machine, and is built as an integral part of the table, spindle, and chuck unit.



Bullard Turret Lathe of New Series

The new series includes not only the four machine sizes previously built, that is, the 24-, 36-, 42-, and 54-inch sizes, but also a 64-inch size. This new size follows the general design of the four others, but it accommodates work up to 66 inches in diameter. The height clearance is 34 inches under the cross-rail and 48 inches under the turret face. A plain table with parallel and radial T-slots is furnished.

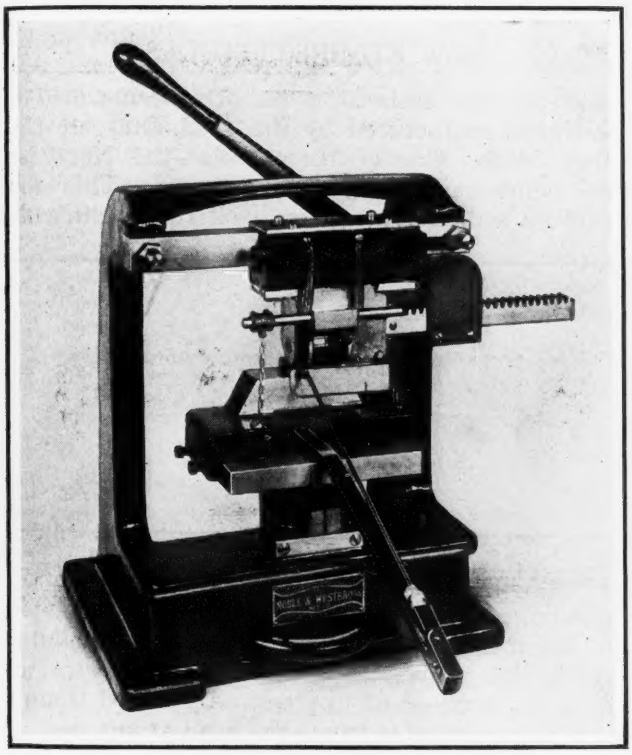
Twelve changes of table speed, ranging from 2 1/2 to 43 revolutions per minute, are selectively obtainable through two systems of sliding gears. The controls interlock with a clutch and brake. Both the main and side heads are provided with eight positive feed changes. The means for adjustment and control are within easy reach of the operator from his natural working position.

The new machine is particularly adapted for large work requiring boring, turning, and facing

operations, using both heads simultaneously. It has a net weight of about 28,000 pounds, and occupies a floor space of 10 feet 6 inches square.

AUTOMATIC NUMBERING AND KNURLING MACHINE

A machine equipped for marking a serial number, identification marks, and a date on the periphery of small rings, as well as for knurling the edge of the rings, is illustrated herewith. This machine is a recent development of the Noble & Westbrook Mfg. Co., Hartford, Conn. It is equipped with a special automatic numbering head which marks the rings as they are placed on a mandrel of the machine. As the operation is completed, each ring is automatically transferred from the supporting pin to a needle which keeps the rings



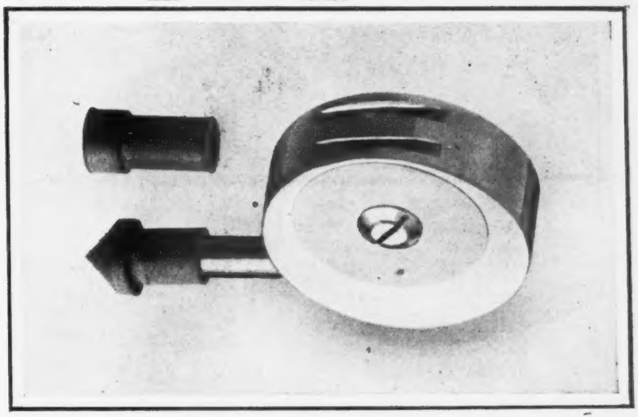
Noble & Westbrook Marking Machine

in order so that they can be conveniently strung on cord or wire in serial order.

Quickness of operation is one of the features, it being merely necessary for the operator to place the rings on the mandrel and operate the lever. The same machine and a similar numbering head can be used for marking various small cylindrical pieces. The complete machine, including the numbering head, weighs 75 pounds.

BROWN & SHARPE SPEED INDICATOR

The latest addition to the line of small tools made by the Brown & Sharpe Mfg. Co., Providence, R. I., consists of the No. 746 vest pocket speed indicator illustrated. This device has only four major parts, and weighs only 1 1/2 ounces. In using the indicator, after it has been set to zero, the thumb of the operator is placed directly on a small dent in one side, and the rubber point is applied to the



Brown & Sharpe Pocket Speed Indicator

center of the wheel or shaft, the speed of which is to be determined.

For every 100 revolutions, the steel plate is lifted once beneath the thumb. To determine the number of revolutions per minute of the rotating part, the number of lifts made by the steel plate per minute is multiplied by 100, and to this number is added the reading that appears in the slot at the top of the tool. Readings appear in this slot in units of five for numbers of revolutions less than 100.

SELECTIVE-SPEED BUFFING AND POLISHING MACHINES

Spindle speeds of 2750 and 2250 revolutions per minute are obtainable in the selective-speed buffing and polishing machines of a line now being introduced to the trade by the United States Electrical Tool Co., 2488-96 W. 6th St., Cincinnati, Ohio. The motor is placed in the machine base, and drives the two spindles through separate belts, as may be seen in Fig. 2. It is possible to stop either spindle independently of the other by operating the levers shown in Fig. 1, which shift either belt from the driving to the idle pulley and vice versa.

The tension of each belt is constantly regulated by means of a steel roller, both of these rollers being visible in Fig. 2. The rollers eliminate the necessity of intermittent adjustments to increase the tension. Each machine is equipped with fourteen ball bearings, chrome-nickel steel spindles,

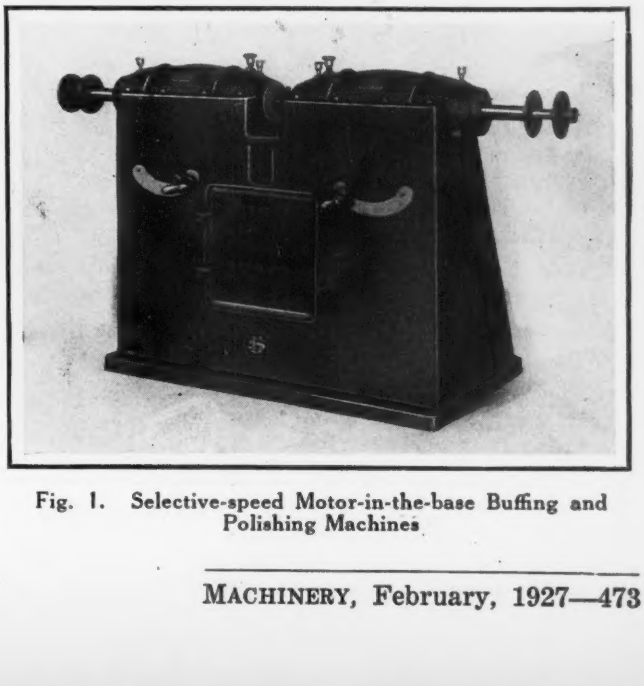


Fig. 1. Selective-speed Motor-in-the-base Buffing and Polishing Machines

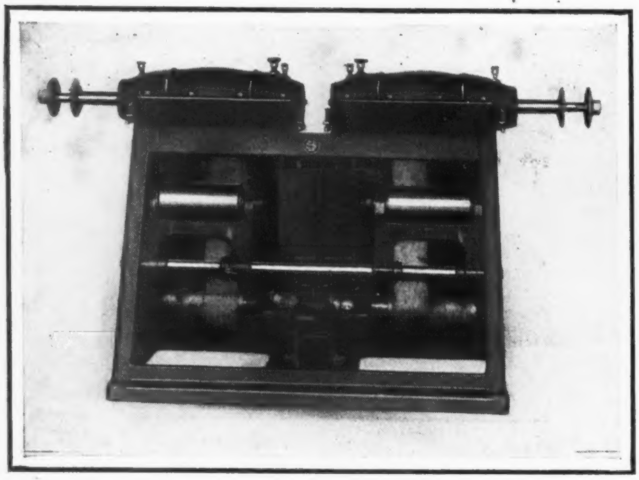


Fig. 2. Rear View, Showing Drive to Both Spindles

and an automatic push-button control. The machines are built in five sizes, of 3-, 5-, 7 1/2-, 10-, and 15-horsepower capacity, respectively.

SYKES IMPROVED GEAR GENERATOR

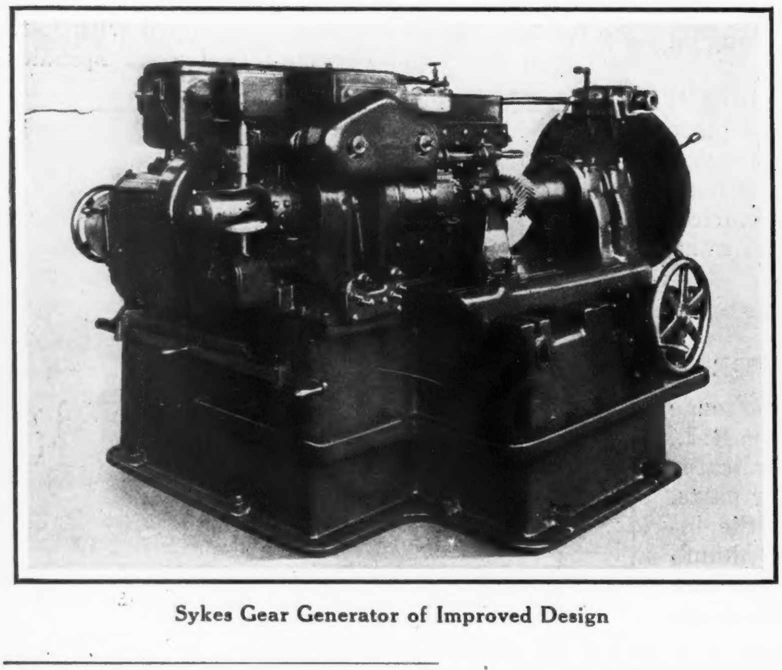
A number of important improvements have been made in the Sykes herringbone gear generator built by the Farrel Foundry & Machine Co., 344 Vulcan St., Buffalo, N. Y., since the machine was described in November, 1925, MACHINERY. The illustration shows the latest design, which is built in three sizes that cut gears up to 25, 36, and 49 inches in diameter, respectively, and up to 8, 12, and 18 inches face width. The changes enable larger cuts to be taken and higher cutting speeds to be used.

The saddle and tail bracket have been made stronger and more rigid. The guides are of cylindrical design, with an improved method of fastening to their respective cutter-spindles. This construction facilitates the changing of guides when it is desired to cut straight-tooth gears.

The reciprocating carriage is made with a deeper box section to increase the rigidity and the bearing surface. Oil from a well lubricates the carriage copiously at all times. The cutter-head has a longer base, and all bearing surfaces are covered by plates to prevent dirt or chips from getting between them.

The feed gear-box has been extended to the top of the machine, and includes all moving parts of the relief mechanism. These parts are lubricated automatically. An automatic feed mechanism has been fitted to the work-saddle. This mechanism feeds the saddle toward the cutters and stops it when the right tooth depth is obtained.

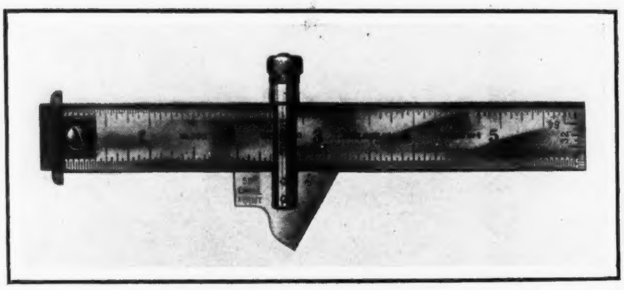
Many minor improvements have also been made, such as the introduction of ball bearings and the automatic lubrication of all moving parts, wherever practicable. It is mentioned that, as a result of the improvements, some types of gears can be produced in one-third of the previous cutting time and that any gear within the capacity of the machine can be produced in one-half the time previously required.



Sykes Gear Generator of Improved Design

NEW STARRETT TOOLS

Several new tools have recently been added to the line manufactured by the L. S. Starrett Co., Athol, Mass. One of these tools—the No. 22-C drill point gage—is here illustrated. This tool combines a drill-point gage, hook rule, plain rule,



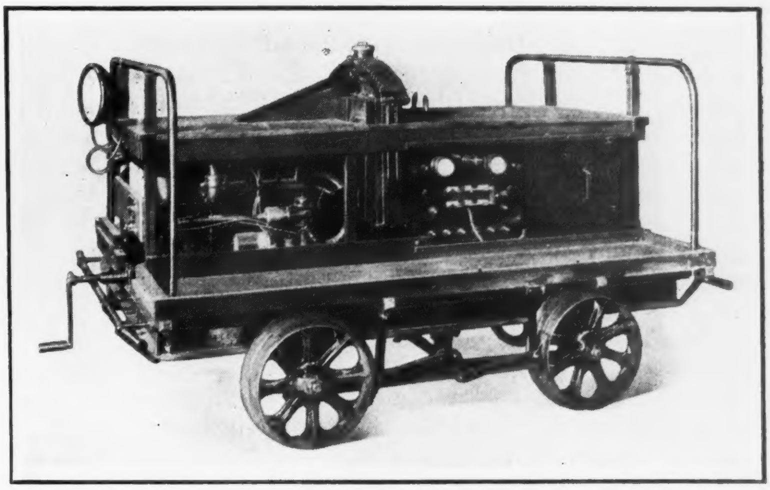
Starrett Drill-point Gage Combined with Hook Rule, etc.

depth gage, try-square, and slide caliper. The steel rule is 6 inches long, and is equipped with a sliding head having an edge that makes contact with the rule at an angle of 59 degrees. A knurled thumbscrew may be used to locate the head at any desired point along the rule.

The hook can be adjusted to be short or long in connection with any one of four graduations. It is possible to set calipers to any of the graduations. The hook may be easily removed or adjusted with a slight turn of the eccentric stud. The drill-point gage head can be furnished separately to mechanics already owning the No. 418 hook rule or the No. 300 or 600 plain rule.

A No. 66 thickness or feeler gage that gives complete range of thicknesses from 0.0015 to 0.025 inch has been placed on the market by the same company. By using leaves in combination, an almost unlimited variety of thicknesses may be obtained. The new gage contains four thin leaves not provided in previous combinations. These leaves are 0.0015, 0.002, 0.0025, and 0.003 inch thick. All the leaves are 3 1/16 inches long by 1/2 inch wide.

A new set of toolmakers' short-length straightedges has also been brought out by the company. These straightedges have beveled narrow edges, and are intended for use on work where tool alignment and accuracy are important. The set consists of six pieces of tempered steel, 3/32 inch thick by 19/32 inch wide, in the following lengths: 1/2, 3/4, 1, 1 1/4, 1 1/2, and 2 inches. These straightedges are furnished in a leather case.



Gas-electric Drive Self-propelled Welding Car

ARMSTRONG SPRING CUTTING-OFF TOOLS

Cutting-off tools of a new spring design are being placed on the market by the Armstrong Bros. Tool Co., 313 N. Francisco Ave., Chicago, Ill. These tools are made in both straight-shank and right-hand offset styles. The gooseneck design gives the cutter a resiliency in lathe operations that takes up all chatter and keeps the work from climbing up on the tool, the latter tendency often causing breakage of tools.

The cutter is adjustable to provide any desired clearance and to obtain the greatest possible amount of support. Cutters are beveled on both sides and are held in the holder at an angle, giving side clearance and top rake. These tools are made in various sizes for cutters ranging from 3/32 by 5/8 inch to 3/16 by 1 inch. The shanks range from 3/8 by 7/8 inch to 3/4 by 1 5/8 inches.

Armstrong Spring Cutting-off Tool

SELF-PROPELLED WELDING CAR

A self-propelled gas-electric drive welding car has been brought out by the Electric Arc Cutting and Welding Co., 152-158 Jelliff Ave., Newark, N. J. The equipment consists of the company's standard gas-engine set mounted on a standard track car. The car may be placed on and taken off the tracks by means of the frame sliding on the rails. The car is equipped with a standard vehicle series motor, and is chain driven. One side is insulated to conform with standard railroad practice.

The control equipment is interlocking, and provides even speed gradation ahead and reverse and a neutral position for welding. When the engine is delivering power, the car cannot be moved in the other direction, and when welding, it cannot be moved at all. A special lighting transformer is provided for illuminating work at night.

The oiling system is so interlocked that the ignition magneto will be cut off should the oil be too low or the pump fail to work. Another feature of the gas engine is that, besides being equipped with a mechanical governor limited to various speeds by the interlocking mechanism, the engine is also arranged with a throttle governor for welding. Thus, the engine can run idle until the electrode is actually touched to the work, and it immediately resumes idle operation when the arc is broken. The welding generator permits the use of both alternating and direct current for arc welding.

WAUKESHA UNIVERSAL TOOL-HOLDER

The tool-holder now manufactured by the Waukesha Tool Corporation, 281 Twenty-third Ave., Milwaukee, Wis., makes it possible for a lathe operator to take right-hand, left-hand, and center cuts by means of one tool, without removing the tool-holder from the post of the cross-slide. This tool-holder is also intended for use on planers, shapers, and other machine tools.

The tool bit is held firmly between two wedge-shaped circular parts in such a manner that the greater the back pressure on the tool bit, the more firmly it is held. The tool bit can be conveniently swiveled to any angle. Four sizes of this tool-holder are manufactured, to meet the needs of a very wide range of work.

One Application of the Waukesha Tool-holder

WARNER & SWASEY TURRET LATHE TOOLS

Several turret lathe tools recently added to the line of equipment manufactured by the Warner & Swasey Co., Cleveland, Ohio, are here illustrated. These tools have been brought out with the view of making it unnecessary for turret lathe users to make special tools. Fig. 1 shows a box chuck designed for holding work of awkward shapes, where rigidity and accuracy are required. It may be equipped with blank or dovetail adapters, such as shown to the left of the chuck. The work jaws are held in these adapters and fit the permanent jaws.

This box chuck has a coarse-pitch right- and left-hand screw which enables the jaws to be quickly opened for reloading. The master jaws are forgings fitted with bronze bushings, and are deeply anchored in the chuck body. The jaws are tapped to receive the right- and left-hand screw, thus eliminating half-nuts. The chuck flange is recessed to suit faceplates, and, therefore, the chuck can be fitted to the spindle of any machine.

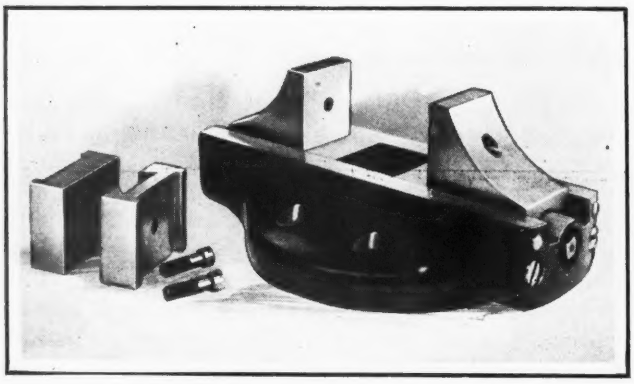


Fig. 1. Warner & Swasey Box Chuck

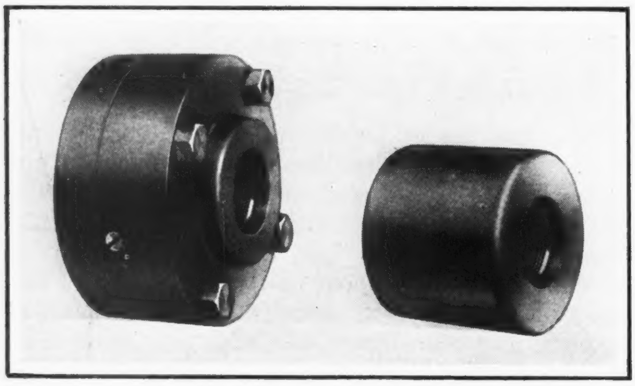


Fig. 2. Plain and Adjustable Adapter Hoods

Both plain and adjustable types of adapter hoods, such as shown at the right and left, respectively, in Fig. 2, are also available. These hoods are made in standard sizes for screwing on the spindle noses of different machines, and are threaded to fit the various styles of adapters. The plain type is intended for ordinary work, while the adjustable type is best fitted for very accurate work. With the latter type, it is possible to align the adapter and the work so that they will be concentric after the work has been placed on the adapter.

Adapter plates of the design shown at the left in Fig. 3 are now made for adapting flanged tools, including the single- and multiple-cutter turners, to the universal hollow hexagon turret lathes made by the company. These adapter plates are tapped so that the smaller tool flanges can be fastened to the turret faces of the larger machines. The plates vary according to the tool and the size of the machine.

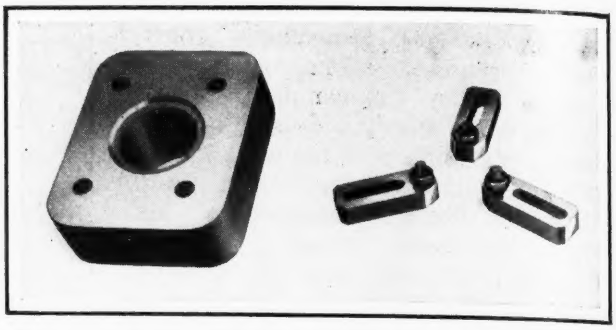


Fig. 3. Adapter Plate and Adjustable Chuck Back-stops

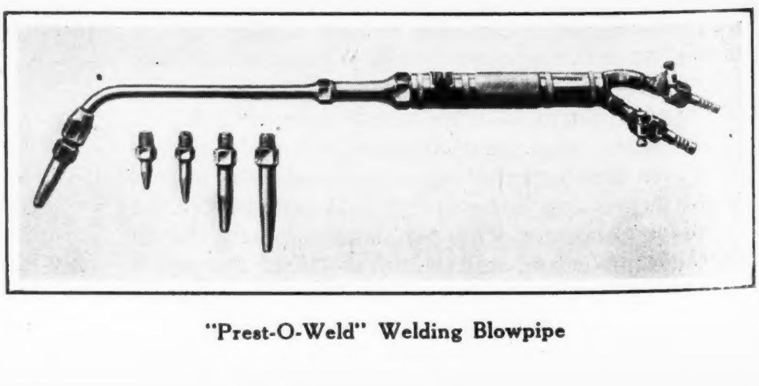
Adjustable chuck back-stops of the construction shown at the right in Fig. 3 constitute a convenient means of locating work endwise on a chuck. They are so accurate as to permit obtaining shoulder distances within close limits, and they eliminate the necessity of making special jaws.

The adjustment provided by the screws is ordinarily of sufficient accuracy for first operations when it is desired to use the screws for plain backing. However, in second operations, or operations where extreme accuracy is required, a cut may be taken on the soft projecting end of the screws. The back-stops can be swiveled on the chuck face for locating the screws. The stops are held in place by bolts screwed into tapped holes in the face of the chuck or by T-bolts that enter slots in the chuck.

"PREST-O-WELD" BLOWPIPE

A new "Prest-O-Weld" W-101 welding blowpipe has recently been introduced to the trade by the Oxweld Acetylene Co., 30 E. 42nd St., New York City. The principal feature of this new blowpipe is that the oxygen and acetylene enter the inlets at about equal pressure. The gases are thoroughly mixed in a simple chamber which eliminates waste of gases and saves the time of the operator in maintaining the neutral or working flame. Economy of gas consumption is claimed for the design.

This welding blowpipe is of all-brass construction, the parts being screwed together on metal-to-metal seats without soldered or packed joints. The blowpipe can be easily disassembled and reassembled when minor repairs are necessary. Stems for the blowpipe are made in three lengths of 4, 9, and 19 inches, and they are made in three angles of 45, 60, and 90 degrees. By simply unlocking a union



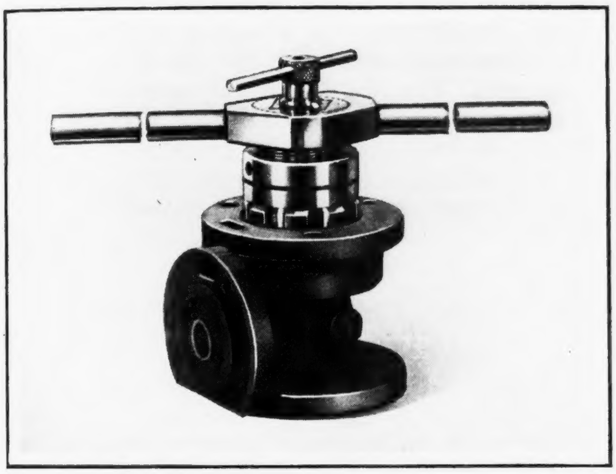
"Prest-O-Weld" Welding Blowpipe

nut, any stem can be fitted to the handle. This feature increases the adaptability of the equipment to the physical peculiarities of work and to preferences of the operator. The over-all lengths of the blowpipe with the different stems are 15, 20, and 30 inches.

Ten interchangeable tips may be obtained, two of which are made of heavily copper-plated brass, and the others of solid drawn copper. The blowpipe is intended for welding work from light metal sheets to heavy castings. A C-101 cutting blowpipe has also been brought out for cutting light and heavy metal sections.

FOSTER-JOHNSON VALVE-BUSHING REAMER

Several sizes of a reamer manufactured for reaming worn bushings of triple valve bodies have recently been developed by the Foster-Johnson Reamer Co., Elkhart, Ind. The reamer blades are expanded radially after the tool is entered into the bushings for the full depth, the adjusting nut being graduated to 0.0005 inch to permit accurate determination of the amount of expansion. Each size has a range of expansion that permits many regrindings during the life of the tool. The illustration shows a reamer in place in a valve.



Foster-Johnson Reamer for Worn Valve Bushings

BRIDGEPORT MOTOR-DRIVEN FLOOR GRINDERS

Three motor-driven floor grinders of 2-, 3-, and 5-horsepower capacity, respectively, are included in a new line of grinders now being introduced to the trade by the Bridgeport Safety Emery Wheel Co., Inc., 1283 W. Broad St., Bridgeport, Conn. These grinders are equipped with General Electric alternating-current motors of the squirrel-cage type. It is said that the stator insulation successfully withstands temperatures well above 90 degrees C., and also abrasive dust, moisture, acids, etc. The spindle is mounted in ball bearings which are locked in place by means of individual nuts. The bearing housings are sealed in a manner to retain oil and exclude grit and other foreign matter. Oil is supplied to the bearings through a sight-level cup.

Bridgeport Motor-driven Floor Grinder

The wheel guards are made of steel plate of a thickness that insures protection from breaking wheels. The guards are fully adjustable, and are equipped with a nozzle at the rear for connecting to an exhaust system. Wheels can be quickly changed through the outside hinged plate of the guards. These grinders weigh 660, 850, and 1150 pounds, respectively.

STOW SCREWDRIVER AND DRILL CHUCK

A screwdriver hand-piece and a drill chuck to which power is supplied through flexible shafts have recently been brought out by the Stow Mfg. Co., Inc., Binghamton, N. Y. These devices are shown in Fig. 1, while Fig. 2 shows a double head which provides a suspended drive to both devices. With this type of drive, the equipment is so counterbalanced that there is no weight for the operator to lift, and both devices are driven by one motor through a double countershaft. A single-head type of drive can also be furnished, and a belt drive from a lineshaft.

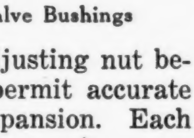


Fig. 1. Drill Chuck and Screwdriver

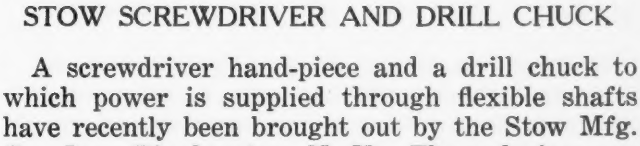


Fig. 2. Stow Double-head Flexible-shaft Drive for Drill Chuck and Screwdriver Shown in Fig. 1

The screwdriver is of a clutch design that relieves itself as the screw is driven home. The clutch may be adjusted for driving the screw to any degree of tightness. The device is equipped with a short bit. For centering wood screws a sliding sleeve may be furnished. This screwdriver is made in two sizes.

ALLEN-BRADLEY SWITCH FOR SMALL MOTORS

A magnetic starting switch that gives small fractional horsepower motors the advantages of push-button control, thermal overload relays, and no-voltage protection has recently been brought out by the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis. This across-the-line starting switch is known as the "Type J-1552 Form B," and is intended for use with alternating-current motors up to 1 1/2 horsepower, in place of knife switches. The steel safety cabinet in which the equipment is enclosed is only 8 inches high, 6 inches wide, and 4 1/2 inches deep, and can be readily installed on small machines.

Magnetic Switch for Small Motors

The switch is made in three styles, the form B-1 being shown in the illustration. The cover of this style is equipped with start-and-stop push-buttons, so that the push-button station and the switch are combined in one unit. The form B-2 switch is without push-buttons, being arranged for an external push-button or pilot-circuit control. The form B-3 switch is equipped with a two-way lever, which gives both hand and automatic control. When this lever is placed in a central position, the switch is inoperative.

CISCO AUTOMATIC TAPPING MACHINE

In December MACHINERY, a description was published of the "HY-Speed" pneumatic reversing tapping machine developed by W. H. Simmons & Co., Cincinnati, Ohio. Since the publication of this article, the Cisco Machine Tool Co., 1770 Elmore St., Cincinnati, Ohio, has acquired ownership of this machine, including designs, patterns, manufacturing rights, etc., and the machine is to be renamed the Cisco "Multi-Tap."

This machine is of the bench type, with capacity up to 3/16 inch in steel and 1/4 inch in brass, and is now in production at the Cisco plant. Within the next month a larger size of the Cisco "Multi-Tap" will be in production, in both bench and pedestal types, having a capacity for tapping up to 1/2 inch in steel and 5/8 inch in brass, thus meeting the requirements of a still wider range of manufacturing operations.

Before deciding to take over the building of this line, the Cisco Machine Tool Co. had one of these automatic tapping machines in its exhibit at the exposition of the American Society for Steel Treating in Chicago last September. Its speed of operation, and the fact that its fully automatic control leaves both of the operator's hands and all of his time free for handling the work, attracted great interest among visiting production executives.

SHOP FLOOR CLEANER

The cleaning of oil or grease from shop floors has always been a difficult matter, and it is, therefore, of interest to note that an absorbent floor cleaner intended for removing oil and grease from shop floors has been brought out by the Flor-Flos Co., Gardenville, N. Y. This material, known as "Flor-Flos," is said to overcome the shortcomings of ordinary methods of cleaning and sweeping, which fail to cut or absorb the oil so that it can be removed. The new material is non-combustible and very easy to use. A handful of it is scattered and pressed well into the oil, grease or water, and it is then stirred around with an old broom, after which the floor can be swept clean and free from oil.

* * *

INCREASING USE OF ELECTRIC SCREW-DRIVING EQUIPMENT

In a conversation with the general manager of one of the leading companies in the electric and pneumatic tool field, it was mentioned that among the developments in this field at the present time are the increasing uses of machinery for driving screws by power instead of by hand, in which direction great strides have been made during the last two years. In this field there are always new applications and many sales are now made for this purpose. The opportunities for growth in this field are marked, because of the great number of screws used in automobiles, railway cars, etc., that can be quickly and economically driven by power, thereby materially reducing manufacturing costs.

While the electric tool field has grown at a faster pace than the field for pneumatic tools, the latter, nevertheless, hold their own in the industry, and new applications are found in this field as well. One large company, for example, expects considerable increase in the pneumatic tool business in 1927, through the development of a new line of pneumatic equipment and tools for contractors.

* * *

TRACTORS TO RUSSIA

According to information issued by the Amtorg Trading Corporation, 165 Broadway, New York City, the Soviet Union has recently purchased agricultural machinery to a value of $4,500,000, including 5000 tractors bought from the Ford Motor Co. and the International Harvester Co. It is stated that during the last two and one-half years 27,000 tractors have been shipped to the Soviet Union by the Amtorg Trading Corporation.

USING OAKITE COMPOUNDS FOR CUTTING, GRINDING AND RUST PREVENTION

In a paper read before a recent conference of the field representatives of the Oakite Products, Inc., formerly the Oakley Chemical Co., 22 Thames St., New York City, P. A. Pinsoneault gave directions for preparing compounds for cutting, grinding, and rust prevention, containing "Oakite" in conjunction with other materials.

Referring first to cutting compounds, the author mentioned the universal practice of using a soluble oil in some of its various forms, together with water, as a cutting compound. The amount of oil varies with the material being machined, common practice being to use from one part of oil to ten parts of water, to one part of oil to twenty parts of water. The difficulty met with in the use of such a solution is that the oil and water frequently separate, so that there is not an even flow of the oil in the solution at the cutting point. This decreases the cooling and lubricating effect of the compound, resulting in the burning of tools. It also permits the water to attack the surface being machined, causing rust.

It was stated that 1/2 ounce of "Oakite" per gallon of solution would prevent the separation of the oil and water and would hold the oil in suspension, so that the difficulties referred to would not be met with. In some shops where, at certain times of the year, rust conditions are exceptionally bad, substitution of "Oakite" composition No. 1 was said to eliminate this trouble. It is difficult to specify the amount of this composition to use under conditions of this kind, because of the different causes of the rust, but it is generally best to start with 1 ounce of the composition to 1 gallon of cutting compound, adding the composition, if necessary, until the trouble is overcome.

The following directions were given for the use of "Oakite" in a cutting compound. The machine should be well cleaned before starting. Clean water should be used in making up the new solution, and as large a stream as possible should be carefully directed on the cutting point.

"Oakite" in the cutting compound retards the action that causes the solution to become rancid, and therefore reduces infection hazards. By keeping the oil in solution it permits higher cutting speeds to be used and greater production to be obtained. It permits more work to be done between grindings, and the author stated that he knew of cases where twice the amount of work had been done between grindings when "Oakite" was employed in the solution.

Compounds for Grinding

In the early days, all grinding was done dry. The first experiments with a cooling agent or lubricant consisted of dropping one drop of water at a time on the point of contact. This was an improvement over the dry method, and soon the amount of water was increased to a small stream. To-day we find that a very large flow of water or compound is used in grinding operations. Water, however, produces rust. Soda and special water solutions have been used, but these have less cooling qualities and little lubricating effect. Pure oil would be most efficient, but the cost is prohibitive.

A solution that will overcome all these objections consists of a compound consisting of soluble oil (1 part of oil being used to 20 parts of water) to which is added 2 ounces of "Oakite" to a gallon of the solution. This makes a very efficient grinding lubricant and cooling agent. In some cases, where rust prevention properties especially are desired, the amount of "Oakite" may be increased to 4 ounces, but experience has shown that 2 ounces per gallon covers 95 per cent of all grinding operations. If the amount of "Oakite" is increased to more than 2 ounces to the gallon, the amount of soluble oil in the solution should be increased in proportion. "Oakite" with from 2 to 4 ounces per gallon makes an excellent anti-rust solution. Ground work has a tendency to rust easily, and the use of such a solution is therefore of considerable advantage.

On work where the side of the wheel must come up to a shoulder, to grind the face of the shoulder, the grinding compound recommended will prove most efficient, for in this type of work the tendency is for the wheel to load more freely. The use of this grinding compound will also reduce the frequency of wheel dressings, as the abrasive points are kept sharp for a longer period.

Rustproofing Compounds

When parts must be rustproofed for a longer period, as for storage in the stock-room and for shipping, they should be treated in a solution made up of 1 part of soluble oil to 8 parts of water, to which is added 2 ounces to the gallon of "Oakite" composition No. 1. This solution should be used hot, and the parts should be permitted to dry before being packed away.

As a rustproofing solution to be used in pickling operations, where acid remains on the parts to be treated, "Oakite" composition No. 2 should be used. This composition acts as a neutralizer of the acid, as well as a rustproofing agent. Experience has shown that this rustproofing medium is very dependable. In an automobile plant, parts so treated showed no signs of rust when placed in various parts of the plant and warehouses for a period of over nine months.

* * *

ECONOMY OF SPRAY PAINTING

Spray painting is becoming of increasing industrial importance. The *National Petroleum News* mentions that the spray painting of lubricating oil drums produces a better job and a less expensive one than is obtained by the brush method. One man can do the work formerly done by three, and only one-half the amount of paint is required. Colors can be quickly changed, using the same air spray gun, by simply blowing one color out of the tube and spray before letting another one feed into the line. It is stated that the paint is sprayed more uniformly on the drums than can be done with brushes. Besides the saving in wages and paint, there is also a considerable item in favor of the air spray in the saving of brushes, because these wear out quickly when used on steel work. Compressed air, of course, is necessary for this work, about 35 pounds pressure being required.

LINCOLN ELECTRIC COMPANY OFFERS PRIZES FOR ARC WELDING DEVELOPMENTS

As briefly mentioned in January MACHINERY, the Lincoln Electric Co., Cleveland, Ohio, manufacturer of electric arc welding equipment, has offered three prizes for the best papers on arc welding developments, to be submitted in a competition during 1927. The American Society of Mechanical Engineers has accepted the custody of the fund of $17,500 provided by the Lincoln Electric Co. for these prizes, which are to be awarded by the society in a world-wide competition. The first prize is $10,000; the second, $5,000; and the third, $2,500.

The prizes are offered with the object of promoting the art of arc welding and reducing the cost of carrying out mechanical designs and construction. The Council of the American Society of Mechanical Engineers will invite qualified experts to assist as judges of the merits of the papers submitted. Complete information may be obtained by application to Calvin W. Rice, secretary, American Society of Mechanical Engineers, 29 W. 39th St., New York City.

Briefly, the conditions governing the contest are as follows: The competition is open to any contestant anywhere in the world, but the papers must be submitted in the English language. They are to be supplied in duplicate to the Secretary of the American Society of Mechanical Engineers at the address given above, before January 1, 1928. Papers received after that date will be excluded from the competition. The awards will be made as soon after January 1 as practicable. The Council of the American Society of Mechanical Engineers may withhold any or all awards.

To assist prospective authors in the preparation of papers for this competition, the following suggestions and conditions are given: The papers should include drawings and careful descriptions of the apparatus needed to carry out the ideas of the writer. The utility of the suggestions must be shown not only for the specific application used as an example, but also for possible use in connection with other designs and for other purposes. The economic saving by the use of the method suggested should be pointed out.

A clear indication of the practicability of the process or design is necessary. Designs that have no practical value will only be considered in case they include suggestions which could be applied in other ways than those suggested. Originality of design is preferable, both in the method of applying the weld and in the design of the welded parts and their arrangement. Methods of applying the arc or the welding process that will improve existing machines or make commercially possible machines which in the light of previous engineering experience have been regarded as impracticable are especially desired.

In case two or more identical suggestions are received, the one arriving in the hands of the Secretary of the American Society of Mechanical Engineers first will take precedence over the second. It is, therefore, advisable to submit all papers in this competition as soon as they have been thoroughly prepared and completed. Papers submitted should be typewritten on one side of the paper only, the size of the paper to be 8 1/2 by 11 inches, and fastened together at the top with protecting covers. The name and address of the sender should appear on the front cover, and if possible, a brief statement of his qualifications should be included in a letter sent with the competing article.

* * *

PERSONALS

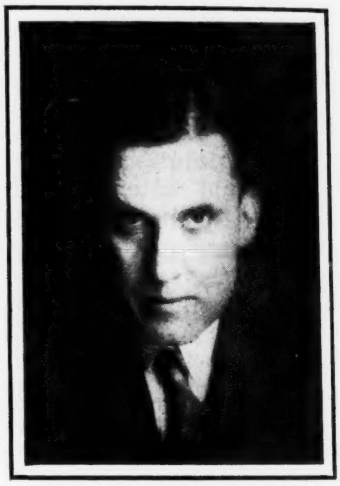
C. E. McGREGOR, formerly of the Republic Flow Meters Co., has joined the Brown Instrument Co., Philadelphia, Pa., and will handle the sales of the new Brown electric flow meter in the Chicago territory.

CHARLES E. SKINNER, assistant director of engineering, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been re-elected chairman for 1927 of the American Engineering Standards Committee.

HARRY J. LACKEY, formerly with the sales department of the Bicknell Thomas Co., Greenfield, Mass., has joined the sales department of the Triplex Machine Tool Co., 50 Church St., New York City, dealer in machine tools.

GRAEME ROSS has been appointed industrial division manager of the St. Louis office of the Westinghouse Electric & Mfg. Co.; B. W. STEMMERICH, transportation division manager; and J. J. THOMASON, central station division manager.

JOHN W. HENDERSON, formerly with the Ferris-Simpson Co. of Dallas, Texas, has joined the sales organization of the American Hammered Piston Ring Co., Baltimore, Md. Mr. Henderson will sell American hammered piston rings in Texas and part of Louisiana.



J. A. MC NULTY, New Manager of Jos. T. Ryerson & Son's Jersey City Plant

JAMES L. MAYER and FREDERICK E. OSWALD have opened a sales office for industrial engineering equipment at 332 S. LaSalle St., Chicago, Ill. They are now representing the Dings Magnetic Separator Co. and the Saginaw Stamping & Tool Co., manufacturer of pressed-steel, overhead-conveyor wheels, trolleys, and casters.

ALVIN S. RICH, for four and one-half years with the Wagner Electric Corporation, now has charge of sales for the New York branch of the Industrial Electric Motor & Tool Co., 1 Howard St., New York City, dealer in pumps, compressers, blowers, electric motors, and electrically driven utility tools for industrial plants.

J. A. McNULTY, assistant manager of the Jersey City plant of Joseph T. Ryerson & Son, Inc., Chicago, Ill., has been made manager, to fill the vacancy made by the resignation of H. R. HENEAGE. Mr. McNulty has been with the Ryerson organization for fifteen years, and is well suited through his experience to fill this important post.

M. F. BUTLER, formerly affiliated with the Bock Bearing Co., Toledo, Ohio, has joined the sales force of the Royersford Foundry & Machine Co., Inc., Royersford, Pa., and will cover the states of Illinois, Iowa, Wisconsin, Minnesota, and the portion of Michigan and Indiana adjacent to Chicago, which Mr. Butler will make his headquarters.

J. R. THOMPSON, formerly acting works manager of the Trafford Works of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been promoted to the position of works manager of the same plant. Mr. Thompson first became connected with the Westinghouse organization in 1897 in the capacity of time clerk, and has been steadily advanced since that time.

GEORGE SOLZ, JR., has become associated with the Bridgeport Brass Co., Bridgeport, Conn., and will have charge of

the sales of tubular plumbing supplies, brass pipe and fittings in northern New Jersey and of the Bridgeport-Keating flush valve in the state of New Jersey and Rockland County, New York. All inquiries should be directed to Mr. Solz at 271 Norway Ave., Trenton, N. J.

David F. Noble, who formerly handled the western Michigan and northern Indiana territories for the Marshall & Huschart Machinery Co., has opened an office at 549 W. Washington Blvd., Chicago, Ill. Mr. Noble has secured agencies for the Foote-Burt Co.'s drilling and boring machines, the Chard Lathe Co.'s lathes, and the Rockford Iron Works' straight-side and inclinable power presses.

Arthur S. Day has become sales manager of the second operation machinery division of the Kent Machine Co., Kent, Ohio. Mr. Day has had a wide experience in the sale of special and automatic machinery, and has had practical experience along machine engineering lines. He has been connected with the sales departments of several prominent concerns, including the Niles-Bement-Pond Co., the Hill-Clarke Co., the Fairbanks Co., and the Vonnegut Machinery Co.

J. A. White, formerly manager of the electrical department of the Charles A. Strelinger Co., Detroit, Mich., has been appointed district manager of the new Detroit office recently opened by the Allen-Bradley Co., of Milwaukee, Wis., manufacturer of electric controlling apparatus. Previous to his connection with the Charles A. Strelinger Co., Mr. White was associated for over six years with the industrial sales department of the Westinghouse Electric & Mfg. Co. at East Pittsburg, Pa.

George F. Pain, formerly manager of the electrical department of the Baltimore branch of Fairbanks, Morse & Co., has been recently appointed district manager in charge of the Philadelphia office of the Allen-Bradley Co., Milwaukee, Wis., manufacturer of electric controlling apparatus. The Philadelphia office is located at 421 Bulletin Building. Mr. Pain was connected with Fairbanks, Morse & Co. for over thirteen years, having had charge of the electrical departments of the New York, Baltimore, and Philadelphia offices.

Fred S. Doran has been appointed manager of the Cleveland plant of Joseph T. Ryerson & Son, Inc. The new warehouse plant was purchased from the Bourne-Fuller Co. on January 3. Mr. Doran has been associated with Joseph T. Ryerson & Son, Inc., for twenty-one years. He started working in the office, but later was made salesman and traveled throughout the Wisconsin territory for five years, after which he had charge of the Chicago city territory until he was made assistant to A. M. Mueller, general manager of sales.

FRED S. DORAN
Manager of the Cleveland Plant of Joseph T. Ryerson & Son

James A. Davies has been appointed general superintendent of the South Philadelphia Works of the Westinghouse Electric & Mfg. Co. to fill the position made vacant by the death of H. M. Giles. Alfred Voysey will assume the position of assistant general superintendent formerly held by Mr. Davies. James Lyons has been promoted to the position of supervising production department vacated by Mr. Voysey. Mr. Davies has been connected with the Westinghouse organization for more than seventeen years, having worked his way up through the ranks from a position in the designing room to his present position as an official.

Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has reorganized the engineering department of its East Springfield Works. C. H. Garcelon, formerly manager of the small motor engineering department of the East Pittsburg Works, has been appointed manager of engineering of the East Springfield Works. C. A. M. Weber has been appointed manager of the small motor engineering department at the East Springfield Works. E. W. Denman has been made section head in charge of the fan motor section of the small motor engineering department. A. K. Phillippi will continue to act as resident engineer of the radio engineering department.

Arthur C. Pletz has been appointed sales manager of the miscellaneous machinery department of the Niles Tool Works Co., Division of the Niles-Bement-Pond Co. Mr. Pletz has been associated with the machine tool field as draftsman, sales engineer, tool designer, chief draftsman, and superintendent for various companies. For the last twelve years he has been secretary and general manager of the Morris Machine Tool Co. He will be located at the Niles Tool Works offices in Hamilton, Ohio. L. A. Quinn has been appointed acting manager of the Birmingham office of the Niles Tool Works Co., Division of the Niles-Bement-Pond Co., to take the place of the late N. C. Walpole.

C. H. GARCELON, Manager of Engineering of the Westinghouse East Springfield Works

J. W. Neidhardt has been appointed assistant works manager of the Putnam Machine Works, Fitchburg, Mass., a subsidiary of Manning, Maxwell & Moore, manufacturing the Putnam line of heavy machine tools, and also the recently acquired Detrick & Harvey and Beaman & Smith lines of open-side and standard planers, horizontal boring machines, and special milling machines. Mr. Neidhardt was general manager of the Detrick & Harvey Machine Co. at Baltimore, Md., up to the time that plant was liquidated and the patterns, drawings, good will, etc., together with many of the stock parts on hand, were purchased by Manning, Maxwell & Moore. At that time he became associated with Manning, Maxwell & Moore, and has been working in a consulting and sales engineering capacity up to the time of his present appointment.

Edward Blake, vice-president of the Greenfield Tap & Die Corporation, Greenfield, Mass., for more than four years, has resigned his office and given up active connection with the company. Mr. Blake has been connected with the tap and die industry since 1902, when he entered the employ of the Wells Bros. Co. He remained with this concern until 1911, when he went to Providence, R. I., and became general manager of the J. T. Slocomb Co. After holding this position for three years, he went to New York where he was engaged in business for a year and a half. In 1917 he purchased the Lincoln-Williams Twist Drill Co., of Taunton, the name of the company afterward being changed to the Lincoln Twist Drill Co. In 1922 he went to Greenfield, and was elected vice-president of the Greenfield Tap & Die Corporation in charge of the sales of the company. Mr. Blake will soon announce his future plans.

W. J. Merten, engineer with the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been appointed chairman of the Recommended Practice Committee of the American Society for Steel Treating. Mr. Merten has been a member of the Recommended Practice Committee since its inception, and has also acted as chairman of the sub-committee on tool steels. He has also been chairman of the Pittsburg Chapter of the American Society for Steel Treating.

Donald G. Clark, eastern manager of the Firth-Sterling Steel Co., McKeesport, Pa., was elected a director of the company at a recent meeting. Mr. Clark joined the Chicago agency of the company, E. S. Jackman & Co., in 1903. In 1919 he took charge of the company's business in the east, with headquarters in New York City.

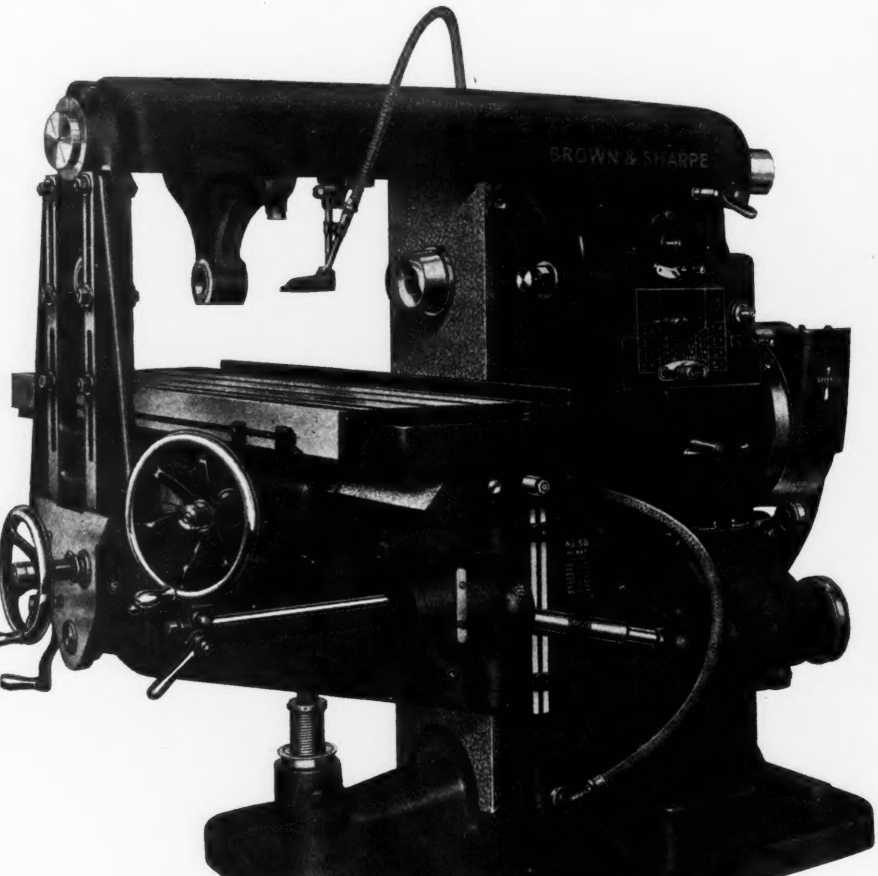
William J. Schaffer, formerly general foreman for the Hanson Whitney Machine Co., Hartford, Conn., has joined the sales department of the Triplex Machine Tool Co., 50 Church St., New York City, machinery tool dealers, and will cover the Connecticut territory for this firm.

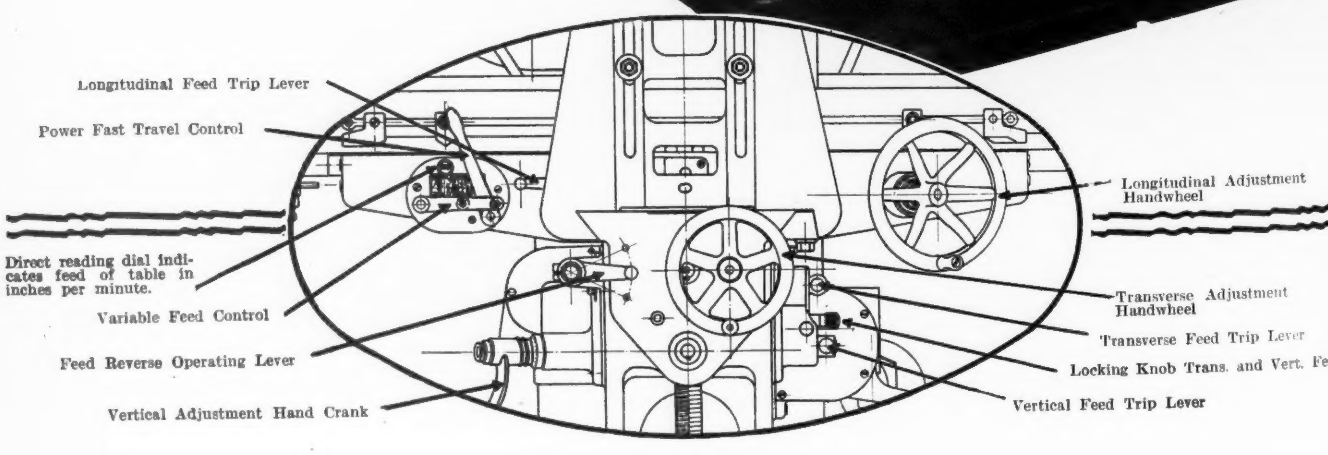
Every table control within easy reach of the operator—

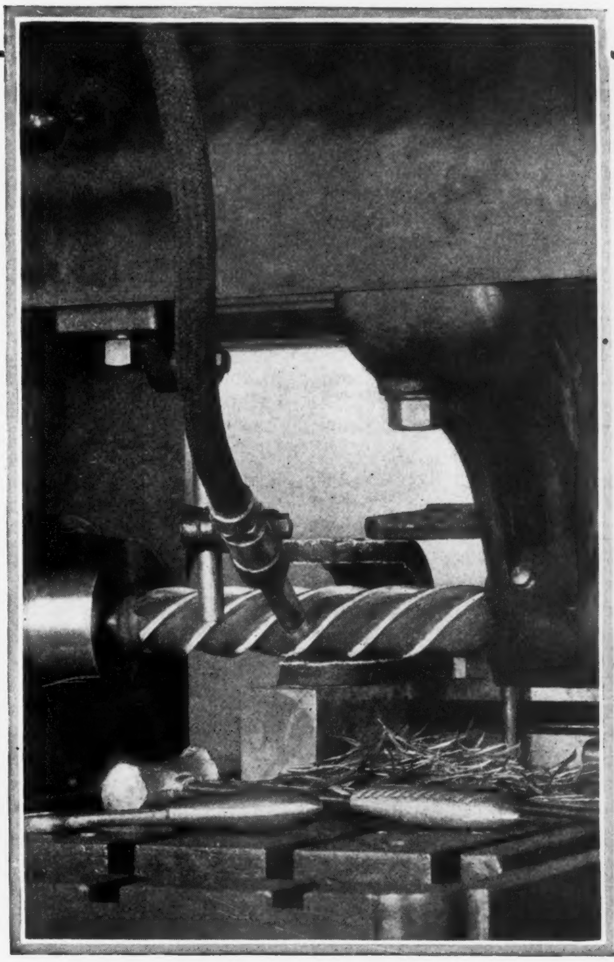
one of the time-saving features of the Brown & Sharpe No. 5B Heavy Plain Milling Machine

All table controls are well within the normal reach of the operator of a Brown & Sharpe No. 5B Heavy Plain Milling Machine. This convenient location saves the operator's time and speeds up production. The simplified control and the facility of handling this powerful production unit are exceptional for a machine of its size.

Let our representative give you further facts about this modern milling machine, or, write for specifications.







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That increased power available in modern milling machines, such as the Brown & Sharpe No. 5B Heavy, is transformed into production with greater economy on many jobs by using Brown & Sharpe Helical Cutters.

The design developed by the Brown & Sharpe Engineers provides a steep spiral and effective under-cutting for the teeth. The cutter shears its way along on deep cuts and, even in steel, removes more metal with less power consumed. When the cutter runs into a heavy bank of metal in the course of the cut it takes the sudden increase in load easily and smoothly without "gouging" or springing the arbor.

Take up your cutter problems with our representative, and be sure you have a copy of Catalog No. 30. If you have none, write for one today.

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TRADE NOTES

BARDONS & OLIVER, Cleveland, Ohio, manufacturers of turret machinery, announce the appointment of Dayton-Dunbar, Inc., 149 Broadway, New York City, as their New York agent.

TRIANGLE TOOL & PATTERN Co., manufacturer of hardened and ground steel bushings and kindred parts, has removed from 207 Brady St. to a new plant at 12245 Turner Ave., Detroit, Mich.

CLEVELAND WORM & GEAR Co., 3249-99 E. 80th St., Cleveland, Ohio, has established a district sales office in Detroit, Mich., at 2600 Buhl Bldg. H. A. Sparrow is district manager, in charge of the new office.

JOSEPH T. RYERSON & SON, INC., 16th and Rockwell Sts., Chicago, Ill., took over, on January 1, the exclusive sale of the line of milling machines produced by the Kempsmith Mfg. Co., of Milwaukee, Wis.

AIR REDUCTION SALES Co., 342 Madison Ave., New York City, has acquired, through a long-term lease, the plants and business of the COMMERCIAL ACETYLENE SUPPLY Co., INC., located at Berkeley and Los Angeles, Cal.

BURKE ELECTRIC Co., Erie, Pa., manufacturer of motors, generators, and welding equipments, has appointed H. C. Lemire, 407 S. 4th St., Minneapolis, Minn., district sales agent for Minnesota, the Dakotas and the northern part of Wisconsin.

RELIANCE ELECTRIC & ENGINEERING Co., 1056 Ivanhoe Road, Cleveland, Ohio, manufacturer of Reliance alternating- and direct-current motors, has opened a central New York office in the Onondaga Co. Bank Bldg., Syracuse, N. Y. Charles D. Herbert will be in charge of the new office.

PERCY M. BROTHERHOOD & SON, 25 Church St., New York City, dealers in machine tools, cranes and hoists, announce that they are offering for sale the entire machine shop equipment of the Blake & Johnson Co. Machinery Division, Waterbury, Conn. The machines can be seen in operation at the plant.

UNION MFG. Co., New Britain, Conn., has purchased and will take over immediately the entire assets of the Franklin-Moore Co., of Winsted, Conn., that have to do with the manufacturing of a complete line of chain hoists, blocks, trolleys, etc. No change in the organization of the Union Mfg. Co. is contemplated.

BUFFALO FORGE Co. and BUFFALO STEAM PUMP Co., Buffalo, N. Y., announce that their Philadelphia office in the Land Title Bldg. is now in charge of W. S. Koithan and R. W. Pryor, Jr., who have for many years been joint managers of the New York office. They will also continue to manage the New York district.

U. T. HUNGERFORD BRASS & COPPER Co., Lafayette, White, and Franklin Sts., New York City, announces the merger of the company with the CHASE BRASS COMPANIES, INC. This merger will place the Hungerford Brass & Copper Co. in a position to make direct shipments from the mills at Waterbury, Conn., as well as to give warehouse service in New York City.

FOOTE BROS. GEAR & MACHINE Co., 232-242 N. Curtis St., Chicago, Ill., has appointed the Progressive Machine & Engineering Corporation, 1335 E. Franklin St., Richmond, Va., district representative covering the state of Virginia. The Banks-Miller Supply Co., of Huntington, W. Va., has been appointed district representative for territory in the vicinity of Huntington.

KENT MACHINE Co., Kent, Ohio (Conveying Machinery Division) has opened a Chicago office at 625 Monadnock Block, with F. E. Schwalb as manager and sales engineer. Mr. Schwalb was formerly chief engineer of the Weller Mfg. Co. His experience in the material handling field also includes that of designing engineer, supervisor of design, and chief construction engineer.

ROCKFORD MACHINE TOOL Co., Rockford, Ill., has purchased the manufacturing rights, good will, designs, patterns, jigs, fixtures, and stock of the ROCKFORD LATHE & DRILL Co. The line comprises Rockford "Economy" lathes built in 12-, 14-, 16-, and 18-inch cone and geared head types, with single and double back-gears. J. G. Anderson, superintendent of the Rockford Lathe & Drill Co., has been retained by the new owners.

WESTINGHOUSE ELECTRIC & MFG. Co., East Pittsburg, Pa., announces that the corporate form of two subsidiaries of the company has been discontinued and that they have been merged with the parent company as branch works. The companies so affected are the Westinghouse Electric Products Co. of Mansfield, Ohio, and the George Cutter Co. of South Bend, Ind. In the future they will be designated as the Mansfield Works and the Street Lighting Department, respectively, of the Westinghouse Electric & Mfg. Co.

BRADFORD MACHINE TOOL Co., Cincinnati, Ohio, announces that at the annual meeting of the company held January 12, S. S. Williams was elected president, succeeding George F. Stewart; and Charles J. Smith was elected secretary, succeeding W. T. S. Johnson. Mr. Williams has been with the Bradford Machine Tool Co. for twenty-five years, and Mr. Smith, for nineteen years. Mr. Stewart and Mr. Johnson retain their interests in the company, although they will not take part in the active management of the business.

AMERICAN PULLEY Co., 4200 Wissahickon Ave., Philadelphia, Pa., manufacturer of pressed steel specialties, was awarded four prizes at the Sesqui-centennial Exposition in Philadelphia. The company received the grand prize for its pressed-steel reels, spools, beams, and beam heads for wire and textile manufacturers; the medal of honor for American steel belt pulleys and American steel shaft hangers; a gold medal for the new American pressed-steel hand truck; and a gold medal for pressed-steel car wheels for hand and inspection cars on railroads.

GENERAL ELECTRIC Co., Schenectady, N. Y., at a recent meeting of the board of directors elected Theodore Beran, H. L. Monroe, and J. A. Cranston, commercial vice-presidents, in charge of the commercial activities of the company in the New York, Central, and Pacific Coast districts, respectively. E. W. ALLEN, manager of engineering, was elected vice-president in charge of engineering, with offices in Schenectady. On account of the temporary absence of vice-president F. C. PRATT, because of illness, G. E. EMMONS was elected acting vice-president to take charge of manufacturing activities.

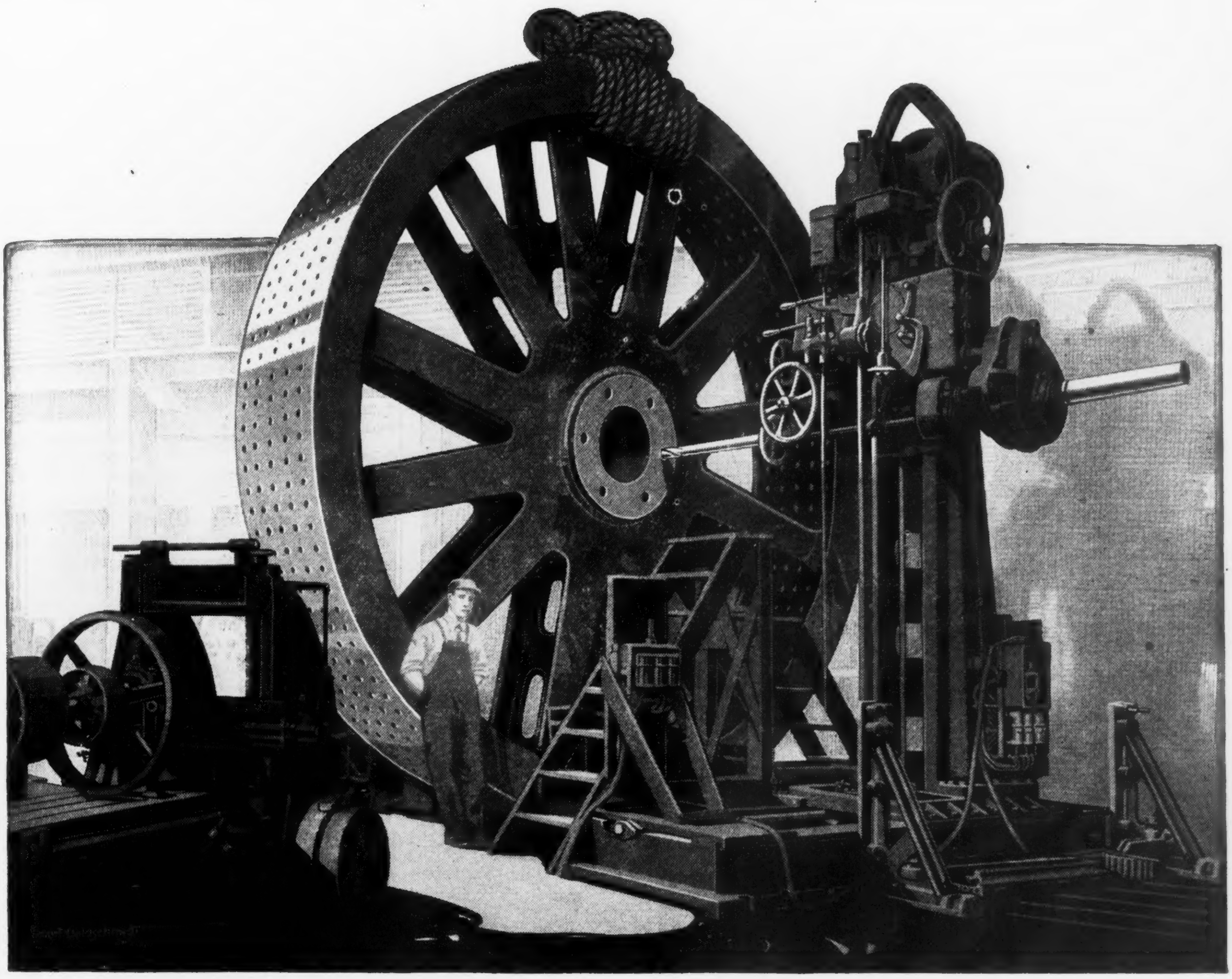
GENERAL ELECTRIC Co., Schenectady, N. Y., was awarded two grand prizes, the highest award given at the recent Sesqui-centennial Exposition in Philadelphia. In addition, the company received three medals of honor and nine gold medals, as well as a number of lesser awards. One of the grand prizes was awarded for "systems of electric transportation and traffic regulation devices," and the other for excellence of products and service to humanity." One of the medals of honors was awarded for "gas-electric system of drives for buses"; one for "Mazda lamps"; and one for "turbine super-charger."

OBITUARIES

GEORGE SIMPSON, formerly chief engineer of the Poole Engineering & Machine Co., of Baltimore, Md., died on December 18 at the age of seventy-nine. Mr. Simpson was born in Smithfield, Va., and at an early age went to Baltimore to work for his uncle, the late Robert Poole, founder of Poole & Hunt, now the Poole Engineering & Machine Co. His marked mechanical ability soon became apparent, and in a few years he was made chief engineer, which position he occupied until 1896, when he resigned to become supervising engineer for the Farrel Foundry & Machine Co. of Ansonia, Conn. After five years service in this capacity, he again became associated with the Poole Engineering & Machine Co. as consulting engineer. About two years ago he retired from active duties because of declining health.

INTERNATIONAL CONGRESS FOR TESTING MATERIALS

An international congress for testing materials will be held in Amsterdam, Holland, on September 12-17. The proceedings will be divided into three main sections, the first of which will comprise the mechanical and physical properties of metals; the second will include building and road-making materials; and the third, oils, rubber, wood and miscellaneous materials. Complete information may be obtained from the Congress Office, Valckenierstraat 2, Amsterdam, Holland.



Reducing the Time of Drilling and Boring Large Bulky Pieces

No Arm or Overhanging Parts to Limit the Size of the Job

VERY often the time spent setting up a job more than equals the actual time the drill is in operation on it, especially when handling large, bulky pieces.

By reducing this handling time the Ryerson Horizontal Drilling and Boring Machines have greatly increased production.

The work table is at the side of the Ryerson Horizontal.

Your crane can place the casting upon it and the set-up is easy. With the turntable and other accessories you can drill, bore, tap, ream, face and back-face all sides of most pieces from one setting. There is a big saving of time which results in greatly increased production. Write for the facts. Ask for Bulletin 4050.

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Denver, San Francisco, Tulsa, Pittsburgh, Minneapolis, Louisville, Los Angeles, Houston

COMING EVENTS

FEBRUARY 15-19—Power Show to be held in Chicago, Ill.

APRIL 4-6—Regional meeting, American Society of Mechanical Engineers in Kansas City, Mo. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

APRIL 25-26—Annual convention of the National Metal Trades Association at Hotel Statler, Detroit, Mich. J. E. Nyhan, secretary, People's Gas Building, Chicago, Ill.

APRIL 27-29—Annual meeting of the American Welding Society at the Engineering Societies Building, 29 W. 39th St., New York City. M. M. Kelly, secretary, 29 W. 39th St., New York City.

MAY 19-20—Spring sectional meeting of the American Society for Steel Treating in Milwaukee, Wis. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland, Ohio.

MAY 23-26—Spring meeting of the American Society of Mechanical Engineers at White Sulphur Springs, W. Va., with headquarters at the Greenbrier Hotel. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 25-27—Annual meeting of the Society of Industrial Engineers at Hotel Stevens, Chicago, Ill. George C. Dent, secretary, 608 S. Dearborn St., Chicago, Ill.

MAY 25-27—National Foreign Trade Council Convention at Detroit, Mich. O. K. Davis, secretary, 1 Hanover Square, New York City.

MAY 25-28—Spring meeting of the Society of Automotive Engineers at French Lick Springs, Ind. Coker F. Clarkson, 29 W. 39th St., New York City, secretary.

JUNE 6-10—Annual convention of the American Foundrymen's Association to be held in Chicago. No exhibition of equipment will be held this year in conjunction with the convention. C. E. Hoyt, executive secretary, 140 S. Dearborn St., Chicago, Ill.

JUNE 7-9—Annual meeting of the Mechanical Division of the American Railway Association at Windsor Hotel, Montreal, Quebec. There will be no exhibits of railway appliances or machinery this year. V. R. Hawthorne, secretary, 431 S. Dearborn St., Chicago, Ill.

JUNE 13-17—Twenty-second annual convention of the National Supply and Machinery Distributors' Association in conjunction with the Southern Supply and Machinery Dealers' Association and the American Supply and Machinery Manufacturers' Association, on board the Steamship *Noronic*, leaving Detroit June 13 and returning June 17. George A. Fernley, secretary, 505 Arch St., Philadelphia, Pa.

JUNE 20-24—Annual meeting of the American Society for Testing Materials at French Lick Springs, Ind. Secretary's address, Engineers' Club Building, 1315 Spruce St., Philadelphia, Pa.

AUGUST 31-SEPTEMBER 2—Annual convention of the American Railway Tool Foremen's Association at the Hotel Sherman, Chicago, Ill. G. G. Macina, secretary, 11402 Calumet Ave., Chicago, Ill.

SEPTEMBER 7-9 — Seventh annual New Haven machine tool exhibition to be held in New Haven, Conn. Harry R. Westcott, Chairman Exhibition Committee, 400 Temple St., New Haven, Conn.

SEPTEMBER 19-23—Ninth annual convention and exposition of the American Society for Steel Treating to be held in Convention Hall, Detroit, Mich. For further information, address W. H. Eisenman, National Secretary, 4600 Prospect Ave., Cleveland, Ohio.

SEPTEMBER 19-24—National Machine Tool Builders' Association Exposition to be held in Cleveland, Ohio, under the direction of the association. For further information, address National Machine Tool Builders' Exposition Manager, Room 635, 1328 Broadway, New York City.

NEW BOOKS AND PAMPHLETS

HIGH SILICON STRUCTURAL STEEL. H. W. Gillett. 23 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper No. 331 of the Bureau of Standards.

ELIMINATION OF WASTE—A PRIMER OF SIMPLIFIED PRACTICE. By Ernest L. Priest. 58 pages, 6 by 9 inches. Published by the Bureau of Standards of the Department of Commerce, Washington, D. C. Price, 15 cents.

TESTS OF LARGE COLUMNS WITH H-SHAPED SECTIONS. By L. B. Tuckerman and A. H. Stang. 88 pages, 7 by 10 inches. Published by the Department of Commerce, Washington, D. C., as Technologic Paper No. 328 of the Bureau of Standards. Price, 40 cents.

THE OXWELDER'S MANUAL. 216 pages, 6 by 9 inches. Published by the Oxweld Acetylene Co., Carbide and Carbon Bldg., 30 E. 42nd St., New York City.

This book contains instructions for welding and cutting by the oxy-acetylene process. It is based upon an earlier instruction book issued by the company, which ran through eight editions, but the present book has been entirely rewritten and brought up to date. The purpose is to instruct purchasers of oxy-acetylene welding and cutting apparatus in the proper technique of its use. Copies of the manual are available free of charge to purchasers of Oxweld equipment. Others can obtain copies by addressing the Oxweld Acetylene Co. at Long Island City, Chicago, or San Francisco.

SUPPLEMENTARY PROBLEMS FOR MECHANICAL DRAWING AND BLUEPRINT READING. By John F. Faber. 136 pages, 6 by 9 1/4 inches. Published by the Bruce Publishing Co., 354 Milwaukee St., Milwaukee, Wis. Price, $1.50.

This book contains 172 problems in mechanical drawing and blueprint reading. It was originally intended as a supplement to the author's "Mechanical Drawing Problems," but the material may be used advantageously with any mechanical drawing text. The work is divided into the following sections: Elementary free-hand sketching; instrumental drawing; sections; intersections and developments; pictorial drawing; detail drawing; assembly drawings; and useful data and tables.

MECHANICAL WORLD YEAR BOOK (1927). 348 pages, 4 by 6 1/4 inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price 1/6, net.

This is the fortieth edition of this little year book, which is well known in the mechanical field. Each year new sections are added and the book is brought up to date. In the present edition, a section dealing with rails and wheels has been included. Another new section deals with the subject of belt conveyors. The section on toothed gearing has been rewritten, as has also the matter relating to condensing plant for steam turbines. New material on air pumps has been added, as well as a table of dimensions of vertical boilers. The section on structural steel work has been revised, and tables of cutting speeds and extra heavy steam piping are included. One of the valuable features of this little book is the classified buyers' directory which is printed in three languages—English, French and Spanish.

FUNDAMENTALS OF THE LOCOMOTIVE MACHINE SHOP. By F. M. A'Hearn. 242 pages, 4 1/2 by 7 1/2 inches. Published by the Simmons-Boardman Publishing Co., 30 Church St., New York City. Price $2.50.

This book is one of a series known as the Railwaymen's Handbook Series. It is designed to fill a long-felt need for a survey of locomotive shop work to be used by apprentices and by those machinists who have worked on one machine so long that they have grown rusty on the others, as well as by officials and executives who are more or less out of touch with the shops themselves. An idea of the contents will be obtained by the following list of chapter headings: Shop Location and Arrangement; Setting Machine Tools; Belting; Shop Operation; The Engine Lathe; Lathe Work; Special Lathes; Planers; Shapers and Slotters; Boring Mills; Drill Presses; Thread Cutting Machines; Milling Machines; Grinding Machines; Work of the Rod Gang; Driving-box Work; Brass Room Work; Motion Work Gang; Tool Grinding; and Miscellaneous Tools.

MACHINE DESIGN PROBLEMS. By S. J. Berard and E. O. Waters. 118 pages, 6 by 9 inches. Published by the D. Van Nostrand Co., 8 Warren St., New York City. Price, $1.50.

This book has been written in response to a demand for a group of problems to supplement the recent book "The Elements of Machine Design," written by the present authors. For convenience, the subject matter follows the same arrangement that was adopted in the textbook. Each chapter has been treated as a unit containing three classes of problems: The first class comprises problems to be solved by calculation, and is intended to make the student familiar with the theory of design and give him a working knowledge of the rules and principles. The second class is suitable for free-hand sketching following previously made calculations for the main proportions. The third class involves the making of working drawings and emphasizes the complete method of design outlined in the first chapter of the book referred to. The problems cover fastenings; shafting, couplings, and clutches; bearings; belting and pulleys; spur gearing; bevel gearing; worm-gearing; screw gearing; cams; linkages; pistons and stuffing-boxes; and piping, fittings, and rolled shapes.

CALENDARS RECEIVED

CARNEGIE STEEL CO., Pittsburg, Pa. Safety calendar for 1927.

NATIONAL TUBE CO., Pittsburg, Pa., manufacturer of seamless tubing.

NEW DEPARTURE MFG. CO., Bristol, Conn., manufacturer of ball bearings.

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis., manufacturer of air compressors, electrical apparatus, engines, hydraulic machinery, power transmission machinery, pumping machinery, saw mill machinery, etc.

NEW CATALOGUES AND CIRCULARS

DRILL CHUCKS. Union Mfg. Co., New Britain, Conn. Circular giving dimensions and prices of the various sizes of New Britain drill chucks.

ELECTRIC FITTINGS. Rattan Mfg. Co., New Haven, Conn. Catalogue of conduit fittings, outlet and concrete boxes, connectors, and conduit benders.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Circular describing the advantages of the use of ball bearings in general-purpose electric motors.

BLOWERS. B. F. Sturtevant Co., Hyde Park, Boston, Mass. Circular descriptive of the Sturtevant "Big Midget" blower—a portable machine for blowing out dust.

DILATOMETERS. Stanley P. Rockwell Co., 66 Trumbull St., Hartford, Conn. Bulletin 2612, descriptive of the Rockwell dilatometer for Volcrit heat-treatment.

SPIRAL LOCK-SEAM PIPE. Naylor Spiral Pipe Co., 1230 E. 92nd St., Chicago, Ill. Catalogue of Naylor spiral lock-seam pipe for conveying materials, liquid solutions, etc.

LUBRICATION PUMPS. Ruthman Machinery Co., Cincinnati, Ohio. Catalogue 1, descriptive of the "Gusher" machine tool lubrication pumps, equipped with individual motors.

GRINDING MACHINES. Blanchard Machine Co., 64 State St., Cambridge, Mass. Circular illustrating the use of Blanchard grinding machines in grinding dies and automobile parts.

VALVES. W. H. Nicholson & Co., 114 Oregon St., Wilkesbarre, Pa. Bulletin 127, illustrating and describing Nicholson three- and four-way valves for air, steam, or water on pressures up to 500 pounds.

UNIVERSAL TURRET LATHE. Warner & Swasey Co., Cleveland, Ohio. Catalogue on the W. & S. new No. 4 universal turret lathe, describing the principle of construction, mechanical features, and tooling equipment.

HARDNESS TESTER. Edward G. Herbert, Ltd., Atlas Works, Levenshulme, Manchester, England. Circular illustrating and describing the Herbert pendulum hardness tester, which measures the hardness of metals by an indentation test.

ELECTRIC FURNACES. Ajax Electrothermic Corporation, Trenton, N. J. Circular dealing with the subject of steel melting in Ajax-Northrup high-frequency electric furnaces. The folder also gives some data on special iron and steel alloys.

MOTOR BASE. Tension Motor Base Co., 15 E. 26th St., New York City. Circular illustrating and describing a tension motor base for vertical, horizontal, or inclined drives. Installations of this device on various classes of machines are illustrated.

WELDING AND CUTTING APPARATUS. Alexander Milburn Co., 1416-1428 W. Baltimore St., Baltimore, Md. Vest pocket edition of catalogue 172E on Milburn welding and cutting apparatus, including torches, regulators, generators, and accessories.

TESTING MACHINES. Riehle Bros. Testing Machine Co., 1424 N. 9th St., Philadelphia, Pa. Pamphlet entitled "Evolution of the Testing Machine," containing a historical narrative of the development of the testing machine from the earliest design up to the present models.

PORTABLE ELECTRIC TOOLS. Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. Circular illustrating the use of "Thor" portable electric tools on a variety of work. Specifications are given for drills, tapping machines, screwdrivers, reamers, and grinders.

MULTIPLE TURNING HEAD FOR TURRET LATHES. Warner & Swasey Co., Cleveland, Ohio. Circular descriptive of a multiple turning head for the turret lathe. Different operations performed with this tool are illustrated, and the set-up time for a particular job is given.

ACETYLENE GENERATORS. Air Reduction Sales Co., 342 Madison Ave., New York City. Catalogue Section No. 5, descriptive of "Airco" Davis-Bournonville acetylene generators, which are made in both stationary and portable types. Capacities and dimensions of both types are given.

CUTTERS. National Tool Co., Cleveland, Ohio. Catalogue F, covering the National Cleveland line of gear and milling cutters, hobs, gear shaper cutters, and special tools. Dimensions and prices of the various tools are given, as well as tabular matter relating to the sizing and cutting of gears.

BORING MACHINES. Universal Boring Machine Co., Hudson, Mass. Bulletin illustrating and describing the No. 24 "Tri-Way" boring machine, which is provided with the "Tri-Way" bed—a bed having three flat ways for supporting the carriage and rear post base. Complete specifications are given.

ROLLER CHAIN. Diamond Chain & Mfg. Co., Indianapolis, Ind. Booklet entitled "Reducing Maintenance and Delays in the Lumber Industry," descriptive of roller chain applications in the lumber mill and woodworking fields. The booklet also describes the construction of the Diamond high-speed roller chain.

ELECTRICAL EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Pamphlet entitled "The Engineering Achievements of the Westinghouse Electric & Mfg. Co. for the Year 1926," outlining the electrical developments worked out by this company during the past year in various fields of industry.

TOOLS. Eclipse Interchangeable Counterbore Co., Detroit, Mich. Catalogue of Eclipse interchangeable Welch plug tools, designed especially for machining cored holes to receive Welch expansion plugs and for accurately setting the plugs in the machined holes. Those interested may obtain copies upon request.

DROP-FORGED TOOLS. Billings & Spencer Co., Hartford, Conn. Handbook and catalogue on drop-forged tools, covering wrenches of all types, eyebolts, chisels, clamps, dogs, ends, extensions, hammers, tool kits, nuts, pliers, punches, ratchets, screwdrivers, thumb-screws, sets, sleeves, sockets, cotter-pin tools, drop-forgings, etc.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Pamphlet entitled "How Fast to Heat in Hardening and How to Control the Rate," discussing the use of the Hump method in determining the proper rate of heating. This is the third of a series of pamphlets on hardening tools or parts.

MACHINE TOOLS. Wickes Machinery Co., 421 Claremont Ave., Jersey City, N. J. Monthly list of the machine tools that this company has in stock. In addition to listing the machine tools available, the booklet contains an article entitled "The Age of Machinery," which is the beginning of a series of articles on this subject that will appear monthly.

VENTILATING AND DUST HANDLING SYSTEMS. Northern Blower Co., W. 65th St. and Denison Ave., Cleveland, Ohio. Bulletin D-100, entitled "Taking the Dust out of Industry," containing a short non-technical explanation of modern dust-collecting methods and of the advantages and limitations of the various types of "Norblo" dust-collecting equipment.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletin GEA-528, illustrating and describing centrifugal air compressors of the small multi-stage type. Circular GEA-544, descriptive of General Electric dynamometers for measuring torque or power. Bulletin GEA-570, containing data on hand starting compensators. Circular GEA-578, on type D mechanical drive turbines.

FLOW METERS. Brown Instrument Co., 4418 Wayne Ave., Philadelphia, Pa. Catalogue 20, of Brown electric flow meters, describing the design, construction, operating principle, advantages, and various applications. The company has also issued an instruction book for flow meter installations, comprising 25 pages of simple directions and diagrams, covering all ordinary installation conditions.

OIL-GROOVING MACHINE. Wicaco Screw & Machine Works, Inc., Stenton Ave. and Louden St., Philadelphia, Pa. Bulletin describing in detail the features of construction of the Wicaco continuous oil-groover, which has been designed for cutting grooves, including straight, cross, and right- or left-hand helical grooves on internal and external surfaces of parts.

ELECTRICAL EQUIPMENT. Electric Controller & Mfg. Co., 2700 E. 79th St., Cleveland, Ohio. Bulletin 1037-C, describing type B limit stops for use with alternating- and direct-current motors. These limit stops are for use on electric cranes and other motor-driven machines that must be automatically stopped. Bulletin 1042-F, describing E. C. & M. automatic compensators for 110- to 550-volt alternating-current squirrel-cage and synchronous motors.

POWER TRANSMISSION MACHINERY. T. B. Wood Sons Co., Chambersburg, Pa. General catalogue No. 70, containing 340 pages, 6 by 9 inches (cloth-bound), covering the line of power transmission machinery made by this company. Dimensions and prices are given for the various products, which include bearings, bushings, clutches, shafting, hangers, collars, conveyors, couplings, pillow blocks, pulleys, transmission rope, sheaves, etc. In addition to the catalogue material, a section of engineering data is included.

MILLING MACHINES. Brown & Sharpe Mfg. Co., Providence, R. I. New milling machine catalogue No. 11A (160 pages, 8 1/2 by 11 inches), listing the complete line of milling machines made by this company, including universal and plain machines of various sizes for tool-room and production work, vertical-spindle machines, manufacturing type units, where fixed table height is advantageous, and automatic machines of three distinct types for the rapid production of duplicate parts. Copies of this catalogue will be sent to those interested upon request.

CUTTING TOOLS, GAGES, ETC. Commercial Tool Co., 2026 E. 22nd St., Cleveland, Ohio. Booklet entitled "Some Notes on Establishing and Preserving Shop Engineering Standards." This pamphlet was published in connection with a course on this subject given by the Cleveland Engineering Society. The book contains illustrations and descriptions of cutting tools; machine tool accessories, such as drill heads, tapping attachments, chucks, etc.; gages; tool-room equipment; and production machinery. The tools shown are made by different concerns.

INSTRUCTION GIVEN IN ARC WELDING

During the last nine years, the Lincoln Electric Co., Cleveland, Ohio, has maintained a department in which more than 1000 men from every state in the nation and from many foreign countries have been given practical instruction in electric arc welding. The instruction period is from four to six weeks, and in no case has a man been charged for the training or been required to remain afterward as an employe of the company. The only requirements set up by the concern for these students is that they must conform to shop rules and be on hand during regular plant hours.

The welding classes were started in 1917 when the United States Government purchased large numbers of arc welding machines from the Lincoln Electric Co. and found that there was a scarcity of skilled welders. To meet this situation, the Emergency Fleet Corporation stationed an instructor at the factory to recruit and train men for welding. When the end of the war came, the officials of the Lincoln Electric Co. decided to continue this undertaking. The students are under the supervision of a welding expert, and are given a thorough practical training. They first learn the fundamentals of welding, and finally are employed on production work.

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The electric power and light industry has increased its capacity almost sixfold within the last twenty years. The capital invested in this field of activity has increased from three and one-half billion dollars to seven and one-half billion dollars in the last seven years. This is almost double the capital invested in the iron and steel industry, and nearly four times that invested in the automotive industry, according to a survey just completed by the National Bank of Commerce.